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West Side Highway Project
Environmental Impact Statement

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United States Department of Transportation
Federal Highway Administration and
New York State Department of Transportation

Draft Environmental Impact Statement and
Section 4(f) Statement for
West Side Highway
Interstate Route 478
Brooklyn-Battery Tunnel to Lincoln Tunnel
New York County
Project Identification Number 0024.11

This improvement is proposed for funding under Title 23 of the United States Code. This statement was developed in consultation with the Federal Highway Administration, and is submitted for review pursuant to United States Code Title 42, Section 4332(2)(c), and Title 49, Section 1653(f).

E. V. Hourigan

E. V. Hourigan, Project Manager
New York State Department of Transportation

Approved and adopted by the Federal Highway Administration:

John G. Bestgen

John G. Bestgen, Division Engineer
Federal Highway Administration
April 25, 1974

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Introduction

Section 1 Introduction

The Project

This document is the "Environmental Impact Statement" of the West Side Highway Project, which has been prepared both to meet the requirements of the National Environmental Policy Act of 1969 and to present to the public and interested agencies the substance of the Project's work. This work has consisted of a comprehensive transportation and land-use planning and design effort for the area adjacent to the Hudson River on the West Side of Manhattan in New York City, carried out by a multi-disciplinary staff under the supervision of City, State and Federal agencies, and of local community representatives, over an 18-month period. The Project has developed alternative proposals for both automotive and public transportation on the West Side, and for future land uses in the area, where appropriate. The Project takes its name from the existing six-lane elevated "West Side Highway," officially known as the Miller Highway, which was built primarily during the 1930's and runs alongside the River from the southerly tip of Manhattan, near the Battery, northward to the Midtown section of the Island.

There has been conscious and consistent consideration throughout the organization and execution of this Project to ensure that it would be a coordinated and comprehensive planning effort very much broader in scope than traditional urban highway studies. A wide range of economic, social and environmental problems and concepts have been as great a concern of this Project as the more traditional transportation and engineering considerations.

Further, from its very outset, the Project has made major efforts to involve the people who live, work or travel in this area in its planning process. Information on the Project and its plans has been made available directly to a broad spectrum of interested community groups and individual citizens, as well as to City, State and Federal agencies and officials with responsibilities related to this work. In turn, the Project has consciously taken into account the reactions and suggestions of these citizens, communities and agencies, as feedback in its development of the alternative transportation proposals presented in this document for review.

In short, the Project has attempted to respond to changing contemporary attitudes with respect to urban transportation planning. A new sensitivity to social and environmental concerns has been expressed vocally by the public, and in a series of laws and regulations of local and Federal governments. These developments have necessitated new approaches and priorities in urban transportation planning. The West Side Highway Project has functioned largely as a conduit for these changing attitudes and ideas.

The West Side

It is important to place this Project in the context of Manhattan's West Side, before describing in detail the elements of its organization and planning. To the casual observer driving along the existing West Side Highway, the picture postcard elements of the area are still outstanding—the skyscrapers of Midtown, the dense buildings of the Financial District, the lines of piers jutting out into the Hudson—all of which epitomize Manhattan as a symbol of man as builder and trader, and help to make New York City unique in this country. However, upon closer examination, a different and changing picture begins to emerge. Midtown offices, shops and apartments are remote from the waterfront. The expansive intervening area of old and low buildings is dotted with empty spaces, parking lots and deteriorating and unused buildings.

The line of Hudson River piers is broken by the skeletons of those which have been destroyed by fire, and the debris of those which have simply fallen into disrepair. Those which are still structurally sound seem to lack their reason for being, since most are now devoted to uses wholly unrelated to the water, such as storage of police and sanitation vehicles. Except for passenger cruises, almost no ships are seen. The extensive acreage of the railroad yards accommodate some assorted trucking and warehousing activities, but large areas of track are overgrown with vegetation, for few trains move here any more.

New construction approaches the water's edge in some areas—housing in the Greenwich Village area, and on the site of the old Washington Street Produce Market in Lower Manhattan. New land is being created in the Hudson at the Island's tip, where Battery Park City is planned eventually to house 45,000 people and provide office space for 30,000 more. The 110-story twin towers of the new World Trade Center dominate the skyline of Lower Manhattan.

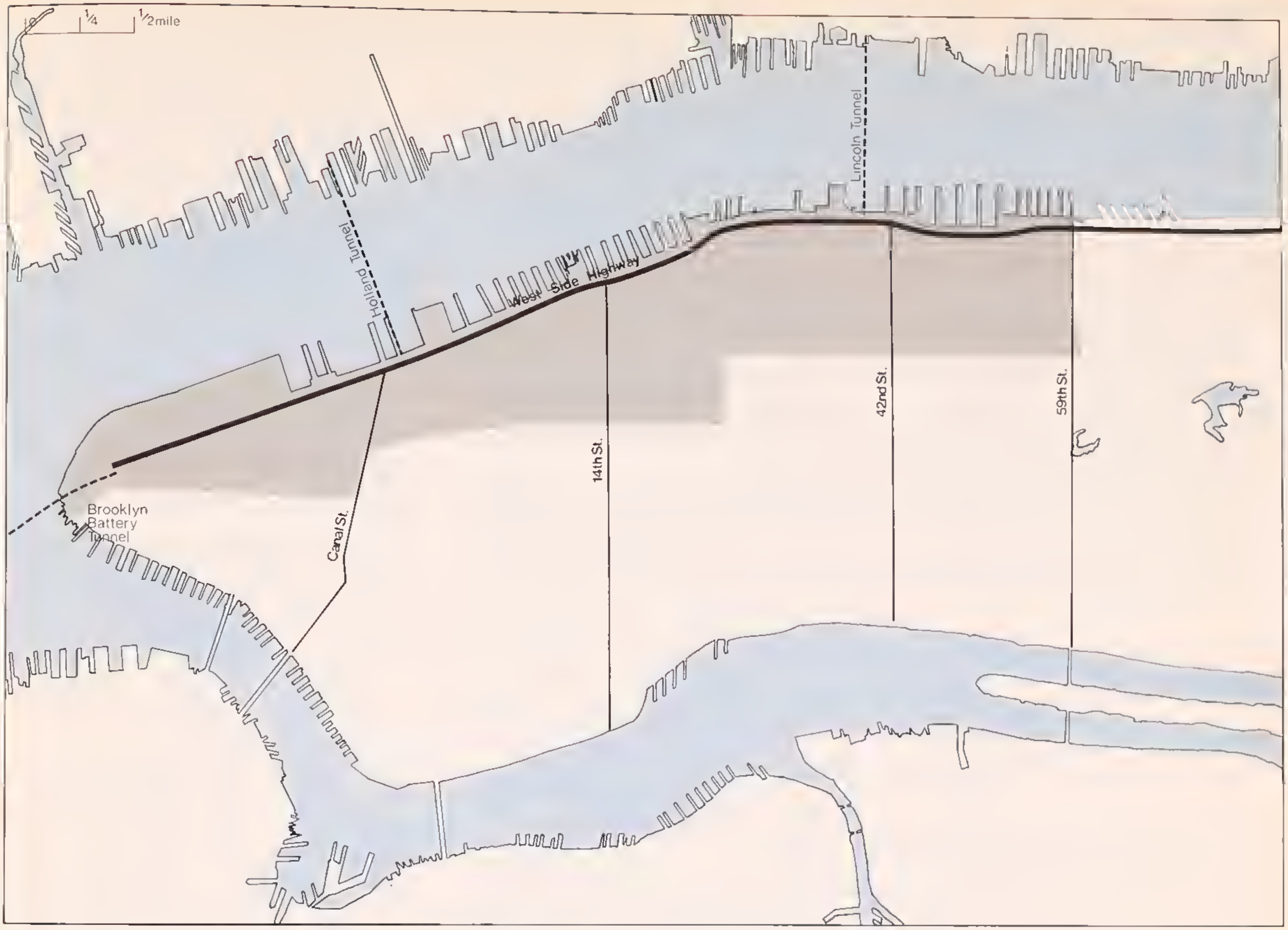

Illustration 1 Location of the West Side Highway Project

But always there is the barrier of the existing West Side Highway, separating the waterfront from the communities behind it. Large portions of the areas east of the elevated highway are filled by warehouses and industrial loft buildings, once thriving, but now suffering from increasing vacancy and neglect.

The West Side between Midtown and the Battery was once a symbol of New York's leading role in commerce and manufacturing, and its dominance of maritime activity in this country. But the drastic declines in Manhattan's manufacturing and shipping sectors have left sizeable portions of "The World's Most Valuable Real Estate" either wholly unused or grossly underused.

The Highway

The line of demarcation between the Hudson shoreline and the interior of Manhattan is the elevated structure of the West Side Highway. When the highway was built in the 1930's, it was admirably suited to its purpose and location. It was carefully fitted between the warehouses and manufacturing buildings on the east and the headhouses of the piers on the west. Its elevated structure allowed vehicles to pass underneath between the piers and the warehouse and manufacturing areas. Its sudden curves and narrow ramps were products of the need to avoid buildings along either side. Its traffic service was adequate for the less numerous, slower moving vehicles of the time.

Forty years later, the inadequacies of the existing highway had become readily apparent and widely recognized. Carrying a significantly increased load of as many as 110,000 cars each day until late 1973, the West Side Highway became an unsafe, obsolete and badly deteriorated traffic facility. The narrow ramps, sharp curves, left-handed entrances and exits, and a crumbling roadbed posed serious hazards. Trucks were prohibited from using the roadway, due to the inadequate size, shape and strength of the ramps and the elevated structure. It became extremely difficult and expensive for the City merely to maintain the existing highway in its interior condition, and that expense was escalating at an alarming annual rate.

The critical condition of the highway was dramatically demonstrated last December by the major collapse of a large section of the northbound roadway south of 14th Street. This collapse, and a subsequent inspection of the elevated structure, necessitated the complete closing of the West Side Highway, between the Battery and 46th Street, for an indefinite period.

Since 1956, there have been six studies of the West Side highway. These have ranged from studies of engineering improvements designed to eliminate sharp curves, to add ramps or to widen certain sections, to the 1971 Wateredge Study of the New York State Urban Development Corporation, which proposed construction of a replacement highway on pilings offshore. Meanwhile, the highway continued to deteriorate, and the question of revitalization of the West Side became more critical for New York City. It became increasingly apparent to City and State decision makers that the long-range redevelopment of this portion of the West Side and the replacement of the West Side Highway were intimately tied to one another. City and State officials agreed that both levels of government would have to be involved in a study of the magnitude and depth needed to accomplish such sweeping dual purposes.

Background and Organization

The designation of an Interstate Highway System link on the West Side of Manhattan by the United States Department of Transportation in 1971 provided the initial mechanism and funding necessary for such a comprehensive transportation planning effort. Originally, the State of New York had requested such a designation between the Brooklyn-Battery Tunnel and the George Washington Bridge. By law, Federal Interstate routes must constitute system components, connecting one Interstate highway with another. The only practical West Side connections were the Brooklyn-Battery Tunnel at the southerly tip of the Island and either the George Washington Bridge at 178th Street or the Lincoln Tunnel at 42nd Street. However, the New York State Legislature in 1971 enacted a law which had the effect of barring construction of any new Interstate highway within Riverside Park, north of 72nd Street.[1] As a result, the Federal Highway Administration designated as an Interstate Route only that area from the Brooklyn-Battery Tunnel to the Lincoln Tunnel at Midtown, refusing designation north to the Bridge on the basis of the New York State statutory restriction. Consequently, 90 percent Federal funding was made available only for studying a corridor on the West Side between the Battery and Midtown. While recognizing that planning was also desirable for the West Side above Midtown, the City and State agreed to proceed with planning for the designated section, which included most of the critical transportation and land-use problems.

It was recognized by the City and the State that the organization and conduct of such an undertaking would require their mutual agreement and ongoing cooperation. To that end, in December of 1971, Governor Nelson A. Rockefeller and Mayor John V. Lindsay signed an unusual Memorandum of Understanding, which established the organizational and policy framework for a "West Side Highway Project". The stated objective was as follows:

> **"This Memorandum of Understanding between the City of New York and the State of New York sets forth mutually agreeable administrative and organizational arrangements by which a corridor plan will be prepared for the West Side waterfront portion of Manhattan. The term corridor plan means the officially adopted end-product of the planning process; it includes a complete description of the desired pattern of land uses, reconstruction of the West Side Highway and the network of local services associated with a schedule of actions and fundings for which each of the involved entities is responsible. The corridor includes that portion of the Hudson River Waterfront in the general vicinity of the present West Side Highway."**

The Memorandum created a "Steering Committee" as the Project's policy-making body. This 20-member group initially included the heads of 16 City and State agencies concerned with planning and transportation, and the Chairpersons of Manhattan Community Boards One, Two, Four and Seven, representing Community Planning Districts One, Two, Four and Seven, which together encompass the West Side of Manhattan from the Battery well into the Riverside Park area. Subsequently, in August 1973, the membership of the Steering Committee was increased to 22 by the addition of the Chairpersons of Community Boards Nine and Twelve, extending the area represented to the George Washington Bridge. In addition to the six Community Board Chairpersons, the officials on the Steering Committee are:

Administrator, Housing and Development Administration, The City of New York

Chairman, City Planning Commission, The City of New York

Administrator, Economic Development Administration, The City of New York

Administrator, Transportation Administration, The City of New York

Administrator, Environmental Protection Administration, The City of New York

Administrator, Parks, Recreation and Cultural Affairs Administration, The City of New York

Comptroller, The City of New York

President of the Borough of Manhattan

Director, Office of Mid-Town Planning and Development, The City of New York

President, New York State Urban Development Corporation

Executive Director, The Port Authority of New York and New Jersey

Chairman, Metropolitan Transportation Authority

Commissioner, New York State Department of Transportation

Chairman, Battery Park City Authority

Commissioner, Office of Parks and Recreation, State of New York

Director, Office of Lower Manhattan Planning and Development, The City of New York

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[1] New York Highway Law, Section 340-a.

The Memorandum of Understanding sets forth the responsibilities of the Steering Committee as follows:

"Its members shall have responsibility for establishing the basic policies governing the conduct of the study and for identifying and reconciling policy differences so that the planning process may produce the most desirable, economic, and timely overall plan. Policy will be determined and issues resolved by consensus of the Committee."

While this agreement established the policy and decision-making framework for the study, there still remained the question of how to organize it in order to achieve the stated purposes.

During the 1960's, there were profound changes in the way in which urban transportation and land-use planning were conducted. The need for the development and consideration of alternative plans, rather than concentration on a single proposal, was advocated widely. Concern with deterioration of the environment and the potential harm to it by proposed public works increased dramatically. These concerns were written into Federal law in the National Environmental Policy Act of 1969, for all projects requiring Federal approval. Congress thereby mandated a detailed accounting of the likely environmental effects of alternative transportation plans for a given area, including as one required alternative the possibility of doing nothing at all.

An equally important change was the recognition and explicit provision in Federal law for meaningful participation in the planning process by the people who would be directly affected by any transportation proposal—not only those who would drive their cars on a highway or who would ride a new transit system, but also those who would live and work in the area which would be affected. Many projects had come to grief on this issue, including several in New York City. In organizing the West Side Highway Project, the Governor, the Mayor and the Steering Committee recognized and responded to this need for real community participation.

In addition to providing policy direction for the Project, the Steering Committee recognized that a smaller group, composed of persons whose responsibilities bore most directly on the Project decisions, would be desirable for closer supervision of Project planning. This group was formed as the Working Committee. Like the Steering Committee, it has been chaired by the New York State Commissioner of Transportation. General Theodore Parker was Commissioner when the Project first began in 1972; on his retirement in September of that year, Raymond T. Schuler was named to the post by Governor Rockefeller. The Working Committee members were the President of the New York State Urban Development Corporation, Edward J. Logue; the New York City Transportation Administrator, Constantine Sidamon-Eristoff; and the Chairman of the New York City Planning Commission, Donald Elliott. On Mr. Elliott's resignation in February of 1973, John E. Zuccotti was named as Chairman of the Commission. In January 1974, Michael J. Lazar became Transportation Administrator. The roles of the State and the City have been carried forward by new chief officials at each level. Malcolm Wilson succeeded to the Governorship of the State of New York in December 1973, and Abraham D. Beame was inaugurated as Mayor of the City of New York in January 1974.

The man chosen as Executive Director of the Project was Lowell K. Bridwell. Mr. Bridwell had been Federal Highway Administrator from 1966 to 1968 and was well known for his work in reshaping the nature of the transportation planning process in this country. Under his direction, the remaining study staff was assembled.

It was obvious that no single professional discipline could encompass the wide range of expertise necessary for a study of this kind. The study staff was made up of engineers, architects, urban planners, economists and lawyers, as well as support personnel. Consultant staff provided expertise with respect to air, noise and water quality, traffic analysis and control, and socioeconomic studies.

Coordinated Studies

This major planning effort was directed at the West Side "corridor" between the Battery and Midtown. However, shortly after the start of work on the West Side Highway Project, two other intimately related planning efforts were undertaken, in close cooperation with the Project. First, the Steering Committee from its inception had acknowledged expressly that the City of New York placed the highest priority among means of travel upon the improvement of public mass transportation services and facilities. It was deemed desirable to initiate a full-scale planning study of transit alternatives on the West Side, between the Battery and the George Washington Bridge. In order to do so, a grant was obtained from the Federal Urban Mass Transportation Administration by the Tri-State Regional Planning Commission, in cooperation with the New York City Transportation Administration. Under the direction of the Transportation Administration, this "Manhattan West Side Corridor Transit Study" was begun in June of 1972, integrating its work with that of the West Side Highway Project, and operating from the same offices. Thus, public transit options have been developed and evaluated in close coordination with the alternative proposals of the West Side Highway Project. This report presents the alternative transit plans and their evaluation, along with highway and land-use alternatives, although the complete technical aspects of the Transit Study are contained in a separate report.

The second additional study undertaken in conjunction with the Project was a "preliminary feasibility" study for a highway between the Lincoln Tunnel and the George Washington Bridge, the area for which Federal planning funds had been denied. This West Side Highway Extension Study covered the area of the existing West Side Highway between 42nd and 72nd Streets, and the existing Henry Hudson Parkway, which runs through Riverside Park between 72nd Street and the Bridge. This Extension Study was funded and begun in November 1972 under separate contracts by the New York City Transportation Administration and the New York State Urban Development Corporation. Again, it was to be closely coordinated with the work of the West Side Highway Project for the area to the south.

The purpose of this very limited Extension Study, which was undertaken at the request of community groups on the Upper West Side, was to examine the possibility of increasing and enhancing Riverside Park, while improving traffic and environment on the West Side above 72nd Street. If a scheme could be developed which would gain sufficient community support, the restrictive state legislation might be modified. This, in turn, would permit Federal Interstate designation, making funds available for a full scale study of the same scope and depth as the West Side Highway Project, for the area north of 72nd Street. As of this date, no such amendment of the New York State statute has been requested, and will not be requested pending completion of the Extension Study. The results of the Extension Study are presented in a separate report.

Community Participation and Public Information

The actual work effort of the Project took place on several levels. Initially, interdisciplinary teams were established for each of three geographic areas. These team areas corresponded to the Community Planning Districts One (Lower Manhattan), Two (Greenwich Village), and Four (Chelsea and Clinton). The teams, which included planners, architects and engineers, began intensive study of their respective areas in order to identify existing development patterns and future opportunities, constraints and transportation problems, as well as beginning preliminary sketch designs of alternative highway and transit proposals.

At the same time, other studies, such as traffic service, air quality, noise conditions and economic analyses, were begun. These, of necessity, encompassed a varying and much wider geographic area than the team studies, although careful contact was maintained with the local area planners in order to ensure that local issues which had implications beyond the immediate team area received careful attention.

From the outset of the Project, and actually before the planning effort was underway, a comprehensive community participation program was operating. The Steering Committee established this "Community Liaison and Public Information Program" in order to afford people who might be affected the opportunity to be informed and to participate in the Project. The Memorandum of Understanding and the Federal Highway Act contained the mandates for establishing the program, and the Policy Statement of the Steering Committee set forth the specific goals and policies which governed it. The program's main goal was broad and comprehensive:

"Assure that the alternative corridor plans meaningfully respond to the needs and aspirations of individuals and organizations affected by reconstruction of the highway; the quality of the various alternatives will be dependent upon intimate awareness of these factors."

The Steering Committee also laid out four specific policies to guide the conduct of the program. They were:

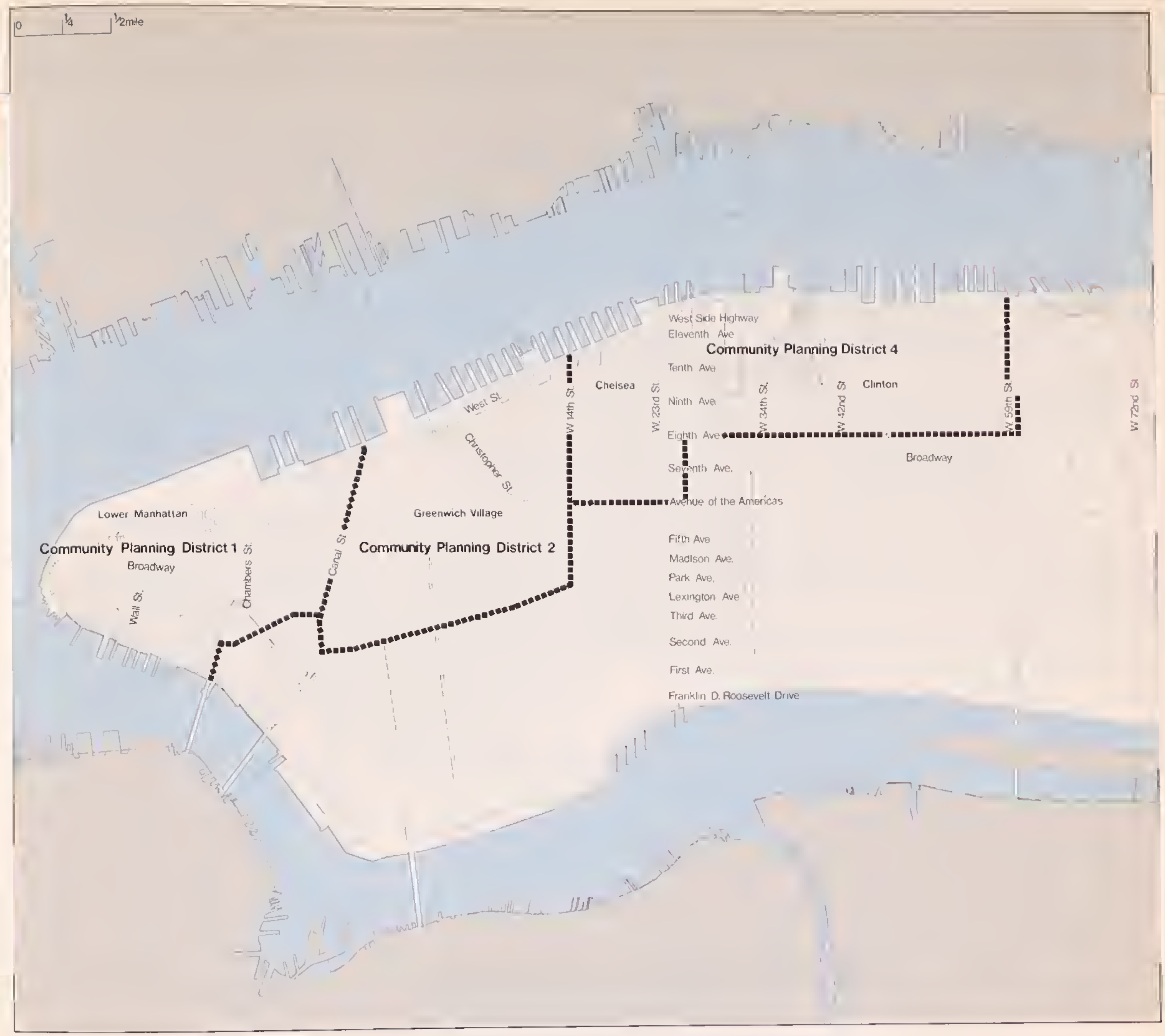
1. **Assist individuals and organizations in the articulation of their aspirations and concerns.**
2. **Actively seek community, agency, and organization participation in the planning and evaluation of alternative program packages.**
3. **Actively inform interested citizens and organizations on progress and decisions.**
4. **Encourage public awareness of all project activities.**

Initial contacts were made through the Steering Committee members, particularly with Community Boards One, Two, Four and Seven. These contacts provided basic information on the communities' aspirations and their goals for future development, as well as their concerns about proposed changes on the West Side. From these initial meetings and the identification of community concerns, it was possible to make contact with other groups and individuals, to elicit their comments and to involve them in the process. To date, the staff has held well over 100 briefings, presentations and working sessions with community organizations—some whose concerns are localized, such as block association or merchant groups, others whose interests are more general and wide ranging.

In addition, there have been at least as many informal conversations between staff members and people representing particular public or private interests. Records were kept and the information obtained was used in the planning and design of Project alternatives.

Finally, an "open file" has been maintained throughout the Project. All Project documents, work programs, progress reports, memoranda, records of community meetings and other material related to the Project's administration, planning and design work has been available to all interested parties. The staff has conducted periodic mailings of important information concerning the Project, and those special studies and reports which concerned particular interest groups were reviewed with those groups, and then revised or expanded in response to their criticisms.

Illustration 2 Local Communities and Community Planning Districts on the West Side


0
1/4
1/2mile
West Side Highway
Eleventh Ave
Community Planning District 4
Tenth Ave
Chelsea
Clinton
Ninth Ave
W. 23rd St
W 34th St
W 42nd St
W 59th St
W 72nd St
W 14th St
West St
Eighth Ave
Christopher St
Seventh Ave
Broadway
Avenue of the Americas
Lower Manhattan
Greenwich Village
Community Planning District 1
Community Planning District 2
Broadway
Chambers St
Canal St
Wall St
Fifth Ave
Madison Ave
Park Ave
Lexington Ave
Third Ave
Second Ave
First Ave
Franklin D. Roosevelt Drive

Policies and Objectives

In August 1972, the Steering Committee formally adopted a policy statement as a basis for all planning and design activities associated with the West Side Highway Project.

In this document, the Steering Committee recognized the opportunity to combine major land use planning with transportation planning in an effort to provide solutions to the following major problems:

1. Obsolescence and under-utilization of the waterfront area.
2. Insufficient employment opportunities.
3. Insufficient land area available for critical land uses.
4. Continuing degradation of the physical environment.
5. Excessive cost of goods movement and distribution.
6. Inadequate transportation systems.

To frame a response to the problems cited above, five broad goals were identified by the Steering Committee:

A. Assure that the alternative corridor plans meaningfully respond to the needs and aspirations of individuals and organizations affected by reconstruction of the Highway; the quality of the various alternatives will be dependent upon intimate awareness of these factors.

B. Minimize disruption, dislocation, and other social and economic costs which may occur from reconstructing the highway.

C. Achieve desirable physical and economic use of the West Side waterfront corridor.

D. Improve the quality of the physical environment by reducing pollution attributable to transportation sources in the West Side corridor.

E. Improve the efficiency and quality of moving people and goods to and from Manhattan, especially within the West Side corridor.

The following statements delineated the policy framework within which the Steering Committee set out to accomplish the goals cited above. No priority is intended by the order in which the statements appear.

1. Assist individuals and organizations in the articulation of their aspirations and concerns.

2. Actively seek community, agency and organization participation in the planning and evaluation of alternative program packages.

3. Actively inform interested citizens and organizations on project progress and decisions.

4. Encourage public awareness of all project activities.

5. Recognize that existing waterfront usage as well as revitalization of the West Side waterfront area is an essential consideration in planning and design of the reconstructed facility.

6. Recognize that development and preservation of substantial public access to the waterfront is a principal ingredient in the formulation of alternative corridor plans.

7. Determine the best means to maintain and/or enhance the existing social, economic, and physical characteristics of the local areas through which the facility passes or abuts, in concert with the local area goals and objectives, both during and after construction.

8. Increase access opportunities to reinforce the viability of existing economic activities within the project influence areas.

9. Investigate the role of goods distribution and production activities along the corridor and, where feasible, develop a means to preserve land areas and develop facilities for the purpose of reducing the cost and increasing the efficiency of providing goods and services for Manhattan—with particular attention to the areas in close proximity to the Lincoln and Holland Tunnels.

10. Develop plans that will assist in the consolidation of motor, rail, and sea borne goods movement, storage, and distribution activities along the project corridor.

11. Develop parking strategies consistent with the needs of each corridor plan and designed in concert with mass transportation schemes to provide for reduction of parking demand in the business districts.

12. Develop alternative land-use strategies that promote orderly rather than precipitous change along the waterfront consistent with the adjacent neighborhoods.

13. Formulate in conjunction with the City and adjacent communities realistic access and waterfront use guidelines to frame future usage of the waterfront area to be accomplished in concert with the highway facility.

14. Provide equitable compensation and assistance to persons and businesses displaced and/or relocated as a result of reconstructing the highway.

15. Stage reconstruction of the facility to minimize travel disruption in surrounding communities during construction.

16. Assure physical and economic compatibility between the reconstructed facility and the present development activities in the project corridor.

17. Respect locational advantages of specific industrial, mercantile, and commercial facilities and seek opportunities to promote their economic viability.

18. Incorporate appropriate air, noise and water pollution control devices and design features in the physical plant of the highway.

19. Provide maximum practicable pollution controls during the construction phase of the project.

20. Assure that the project design reflects compliance with appropriate federal, state and local air, noise, and water environmental standards and additionally that such standards are adhered to during construction.

21. Investigate and evaluate the extent to which alternatives reduce the pollution from transportation sources on the West Side Highway and in the adjacent communities.

22. Assure that reconstruction of the highway avoids diminishing the benefits of pollution control projects being undertaken in the corridor, particularly the North River Pollution Control Project.

23. Develop alternative corridor plans consistent with the City's ability to provide essential public services, especially major utility needs.

24. Assure aesthetic compatibility between the reconstructed facility and adjacent areas along the waterfront.

25. Encourage travel of trucks and buses along the periphery of Manhattan; i.e., on the West Side Highway, and away from the local street system; consider the application of preferential treatment traffic controls.

26. Investigate the application of regulatory and perhaps economic controls, as well as operational traffic controls in the achievement of desirable traffic flow characteristics throughout the roadway transportation system.

27. Assure that traffic conditions on the West Side street system are not adversely affected and attempt to substantially improve them. Special emphasis shall be placed upon the Lincoln, Holland and Brooklyn-Battery Tunnel areas.

28. Control and improve the quality of traffic flow on the West Side Highway over that which currently exists.

29. Provide convenient access along the West Side for the purpose of efficiently collecting and distributing Manhattan traffic to/from the Interstate System which presently terminates at the Lincoln, Holland and Brooklyn-Battery Tunnels.

30. Provide for accommodation of an as yet undetermined amount of travel demand which eventually may be generated by development and/or redevelopment of lands within the corridor, and which presently emanates from major generators.

31. Discourage the attraction of additional regional travel diversions within the corridor, in excess of those currently taking place. Assume the capacity of the tunnels will not be expanded in the future; i.e., program additional capacity for the highway only to accommodate the diversion of traffic from the West Side street system and projected corridor growth.

32. Consider, thus plan and design, the reconstructed facility to function as an integral part of the City and regional roadway transportation system.

33. Improve the streets directly affected by reconstruction of the highway necessary to achieve consistency and balance in roadway traffic flow.

34. Investigate the potential opportunity for utilization of mass transportation within the highway corridor, based upon its demonstrated need and utility, and upon its anticipated inherent benefits; and having determined the degree to which such public transportation services and facilities are warranted, incorporate them in the project.

The Steering Committee met periodically during the West Side Highway Project. Photo/The New York Times

The Planning Process

The diversity of goals and policy statements recognized by the Steering Committee indicates the complexity of problems associated with the Project. In order to accommodate this complexity and to arrive at workable proposals, a clearly defined planning methodology was formulated. It was decided that all alternative highway plans would be developed and evaluated as an integrated collection of transportation and land use elements, referred to in combination as "program packages".

Each program package was conceived initially by the local area planners, in order to maintain consistency between local goals and objectives and Project planning criteria. This level of review was continued as the range of possible alternatives narrowed and the scope of each program package expanded with additional inputs of detailed technical information. After continuous dialogue between Project staff, local communities and government agencies, five program packages have been refined and evaluated for presentation in this report and at public hearing.

During this process, major public and private functions and facilities in the corridor area were analyzed in particular, and the results were integrated into the planning process for generation of alternative proposals. These included the three public projects presently planned or underway in the area, which were cited expressly in the Memorandum of Understanding:

1. **Battery Park City** A new 100-acre community adjacent to the World Trade Center, consisting of residential, commercial and civic facilities.

2. **Consolidated Passenger Ship Terminal** Extensive rebuilding of three piers located between West 48th Street and West 52nd Street to serve as passenger facilities for cruise ships.

3. **New York City Convention and Exhibition Center** Proposed as one of the largest such facilities in the nation, to be built over the Hudson River between 44th and 47th Streets.

Project planning began with the identification of a wide range of preliminary alignments, formulating initial concepts and meeting with public agencies and community groups. The Project staff focused its attention on analyzing land-use trends, traffic patterns, environmental conditions, the potential for public transportation and the socioeconomic characteristics of the corridor. Subsequently, preliminary program package alternatives were outlined, evaluated, and presented to the Steering Committee for their review. Seven alternatives were then selected by the Committee for more detailed study.

Then, the content and design for the selected alternatives were further detailed and refined by the staff. As a result, two of these seven alternatives were eliminated from further consideration. Finally, the five selected alternatives were evaluated in environmental, social and economic terms, in order to determine their impacts, advantages and disadvantages. This is the stage which involved preparation of this Draft Environmental Impact Statement, and will include presentation of the Project alternatives at public hearing. After the hearing, the Project will respond to comments and criticisms of interested people and agencies, prior to recommendation of any alternative.

Purpose of This Report

In accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969,[2] all proposals for major Federal actions which may significantly affect the quality of the environment must be accompanied by a detailed statement covering five major areas:

1. **The environmental impact of the proposed action.**
2. **Any unavoidable adverse effects to the environment should the proposal be implemented.**
3. **Alternatives to the proposed action.**
4. **The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity.**
5. **Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.**

This Environmental Impact Statement is in compliance with the above mandate. Its primary purpose is to identify and evaluate all potential effects of the alternative Project proposals upon the human and physical environment, in order that all interested persons and agencies be afforded the opportunity to review this work and to present their own comments or critiques at public hearing.

Section 4(f) of the Department of Transportation Act of 1966, as amended in Section 18 of the Federal Highway Act of 1969,[3] is directly concerned with the impact of Federal transportation projects on parks, recreation and wildlife areas, or historic sites, which are of national, state or local significance. According to this law, the Secretary of Transportation may approve a project which requires the use of such lands only if: (1) there is no feasible and prudent alternative; and (2) the project includes all possible planning to minimize harm to the Section 4(f) land resulting from such use. While a "4(f) Statement" is required and governed by statute and regulation separate from the Environmental Impact Statement, both are presented in this report in order to facilitate public review, given the relationship between the environment and parklands.

Scope of This Report

This Environmental Impact Statement attempts to take a broad approach in describing the potential impacts of alternative Project proposals. Two of the program packages include a combination of public transit and interstate highway options. Two more alternatives include non-interstate highway options, and a transit facility in conjunction with one of them. The fifth alternative contemplates maintaining the existing West Side Highway.

The content of this report is intended to meet all Federal statutory and regulatory requirements. Recent judicial decisions have significantly expanded Federal transportation planning requirements. The Project has attempted to incorporate these new interpretations as part of its planning and presentation efforts. This draft assumes the validity of the recent decisions which broaden the environmental requirements of Federal law, as of this writing.

Section 2 of this report describes the present and projected conditions on the West Side of Manhattan, in terms of economic, social, environmental and transportation concerns. Then, in Section 3, the Project's five alternative proposals are presented, along with a description of the planning process which led to their development. Section 4 sets out in detail the specific environmental impacts of each Project proposal, presenting the underlying analyses and findings of the Project's technical work programs. Finally, Section 5 is the 4(f) Statement, describing the potential impacts of Project alternatives on parklands.

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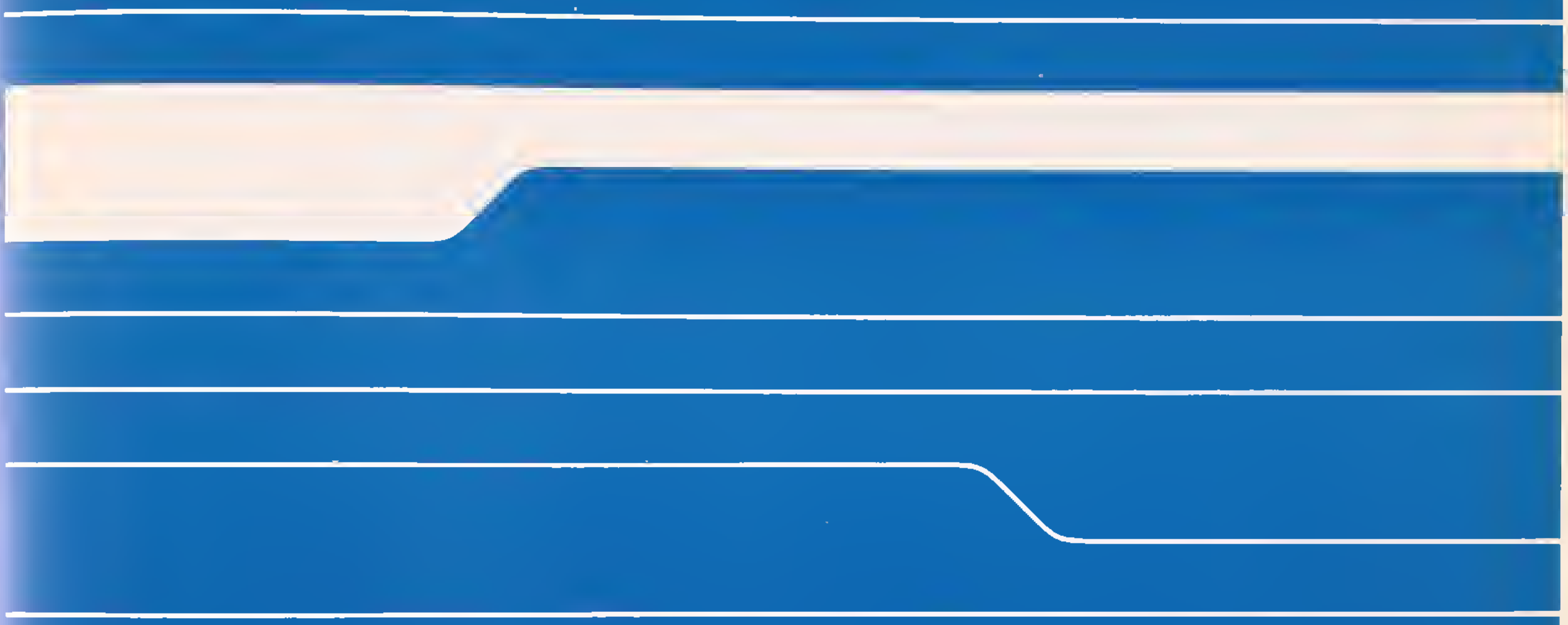
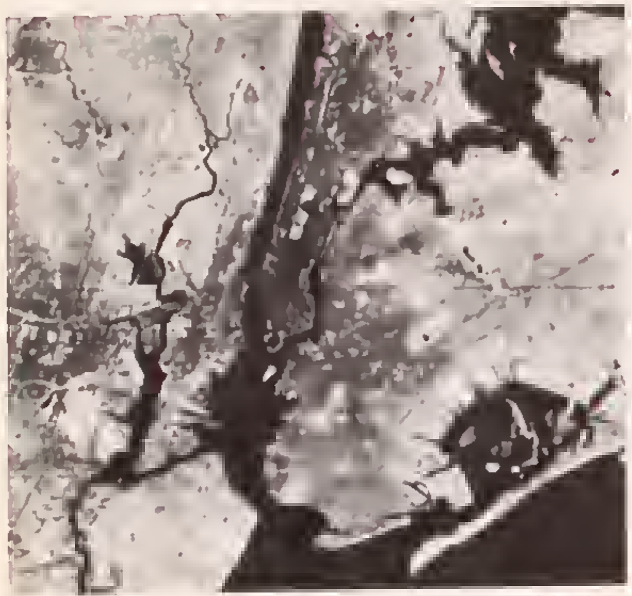
[2] United States Code, Title 42, Section 4332(2)(C).

[3] United States Code, Title 23, Section 138.

Present and Projected Conditions



Section 2 Present and Projected Conditions



A satellite view of the New York Region shows Manhattan Island near the center.

This Environmental Impact Statement presents five alternative proposals developed by the West Side Highway Project for the West Side of Manhattan in Section 3, and then describes the potential effects of each alternative upon various components of the environment in Section 4 .

In order to evaluate the physical, social, economic and other environmental implications of each Project alternative, it is necessary first to understand the existing situation in the area. Further, inasmuch as the Project alternatives have been prepared for a "design year" some 20 years in the future, it is desirable to envision them in a 1995 context, rather than just looking at the present-day world.

Therefore, this section of the Environmental Impact Statement presents the results of the Project's analyses of the existing transportation and land-use aspects of the area. This profile begins with a brief description of the New York metropolitan area, or region, and then progresses to closer and more detailed descriptions, respectively, of Manhattan, the West Side, and each community in the planning area. Each section also includes the Project's analysis of how significant components of the existing situation might change between now and 1995.

The Area

The New York Region

The New York metropolitan area is unique within the nation. It houses nearly ten percent of the nation's population on only about three-tenths of one percent of the nation's area. The New York region is America's financial center, and a principal national hub of the arts, commerce and transportation.

In delineating this area, three different definitions are commonly used by planning bodies and public agencies. The Regional Plan Association (RPA) describes the region as 31 counties in the states of New York, New Jersey and Connecticut, which cover approximately 12,700 square miles. The region as defined by the Tri-State Regional Planning Commission (TSRPC) is smaller, consisting of 27 counties in the three states, covering about 8000 square miles. And the Port Authority of New York and New Jersey uses in its planning a still smaller 18-county region, which excludes Connecticut.

Whatever the outer boundaries of the New York region, its center is always the 22.7 square miles of Manhattan Island. More specifically, the actual core is comprised of only the nine square miles lying below 59th Street, which form the Central Business District (CBD) of Manhattan. Economic activities in this metropolitan area historically have been oriented strongly to the Manhattan CBD.

Illustration 3 **The New York Region**

░ Population in 1960

▒ Population in 1970

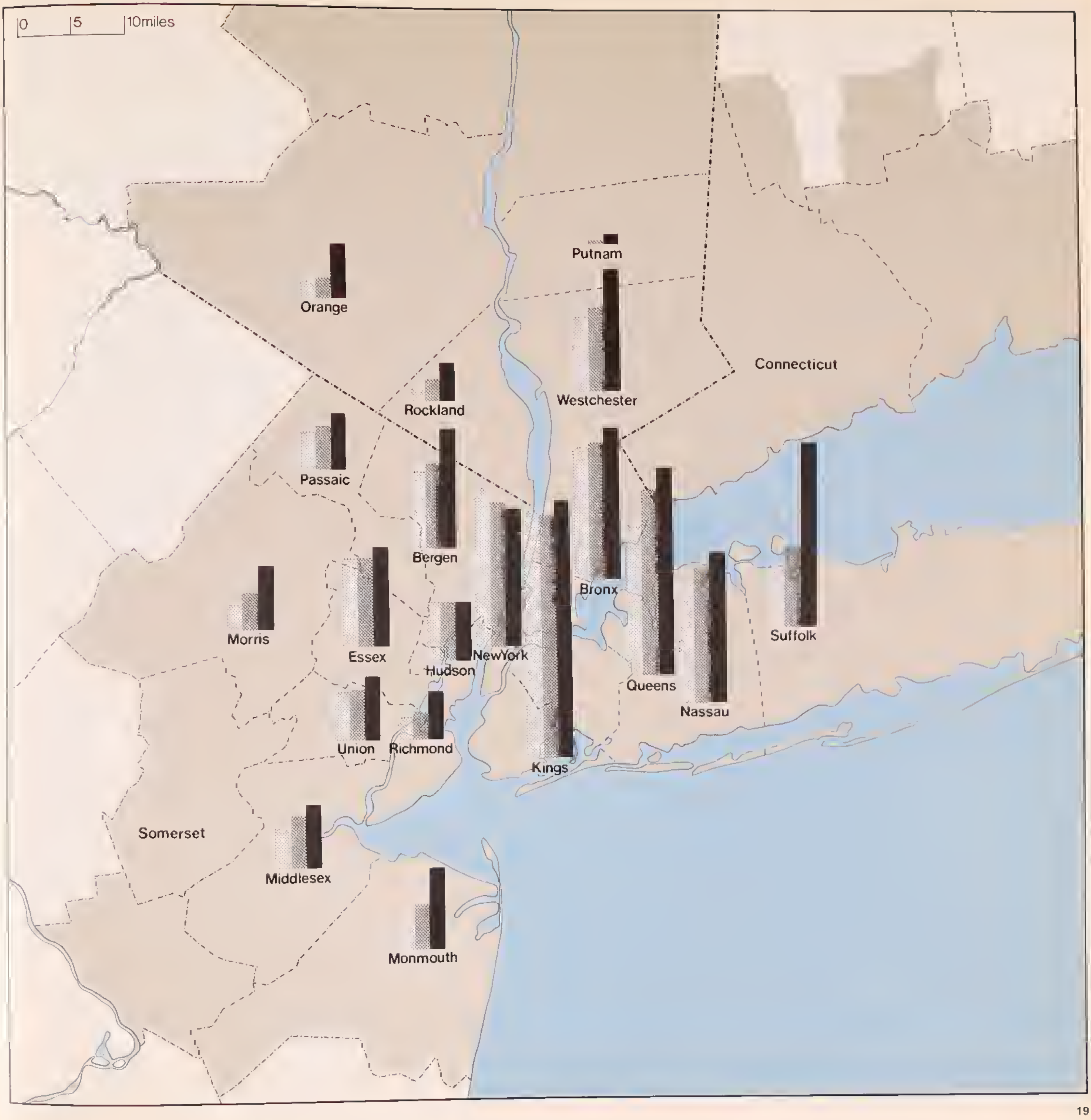
■ Projected Population in 1995

□ The New York Region, as defined by the Tri-State Regional Planning Commission

- - - - - - County Line

-·-·-·-·- State Line

⦶ North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NewYork
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Nassau
Union
Richmond
Kings
Somerset
Middlesex
Monmouth

Aside from being the most populous metropolitan area in the United States, the New York region is growing. In 1970, the population of the RPA region was 19.8 million, an increase of 13 percent over 1960. RPA predicts that the regional population will rise about 25 percent by the end of this century, adding another 4.8 million people to the area, for a total of 24.6 million by the year 2000. (See Table 1.)

The New York metropolitan area is also one of the nation's foremost manufacturing centers, with about 15 percent of the total number of plants in the United States. And the industry is very diverse. Of the 414 kinds of industries identified by the United States Census Bureau, 394 are represented in the New York area. Large-scale and diverse capital investment is continuing.

From 1954 to 1967, $9.4 billion was spent for new plant and equipment in the 18-county region, and no single industry accounted for more than 17 percent of the total, according to the Port Authority's **Industrial Development Guide.** RPA projects that total employment for its region—8.6 million jobs in 1970, will rise to 11.8 million by the year 2000, adding 3.2 million new jobs in the area.

However, closer examination of regional trends and projections reveals that both population and employment increases are not spread evenly throughout the area. As is normal in metropolitan areas, the density of both people and jobs decreases with distance from the center. (See Table 2.) An RPA study has shown that in 1960, more than half of the region's population and employment were located relatively near the center—in New York City (excluding Staten Island), and Hudson County and Newark, New Jersey.

Table 1 Selected Population and Housing Characteristics in the New York Region

Numbers in Thousands

	1960	1970	2000	Change 1960-70		Change 1970-2000	
				Number	Percent	Number	Percent
Population	17,624	19,756	24,600	2,132	12.1	4,844	24.5
Occupied Units	5,524	6,410	9,400	886	16.0	2,990	46.6
Vacant Units	429	353	392	−76	−17.7	39	11.0
Total Housing Units(a)	5,953	6,763	9,792	810	13.6	3,029	44.8
Average Household Size	3.19	3.07	2.62		−0.12		−0.45

(a) Includes population in group quarters.

Source: 1960 and 1970 **Projections for the New York Urban Region's 31 Counties—1985, 2000,** Regional Plan Association, July 10, 1973, Tables 13 and 14; 1995 population and households, **New Regional Projections: A Summary,** Regional Plan Association, March 16, 1973; all other figures, estimated by West Side Highway Project.

Table 2 Distribution of Population and Employment in the New York Region

	Land Area In Square Miles	1970 Population	Percent of Population	Average Density Per Square Mile	1970 Employment	Percent of Employment
Core Area(a)	310.7	8,591,300	43.5	27,651	4,597,530	53.3
Manhattan	22.0	1,539,200	7.8	69,964	2,589,000	30.0
Inner Ring(b)	992.9	4,801,400	24.3	4,836	1,868,830	21.7
Intermediate Ring(c)	3,937.2	4,889,800	24.7	1,241	1,693,650	19.6
Outer Ring(d)	7,507.8	1,473,300	7.5	196	463,580	5.4
Total Region	12,748.6	19,755,800	100.0	1,550	8,623,590	100.0

(a) New York, Brooklyn, Bronx and Queens Counties in New York; City of Newark, and Hudson County, New Jersey.

(b) Richmond, Union, Essex and Bergen Counties in New Jersey and Nassau County in New York.

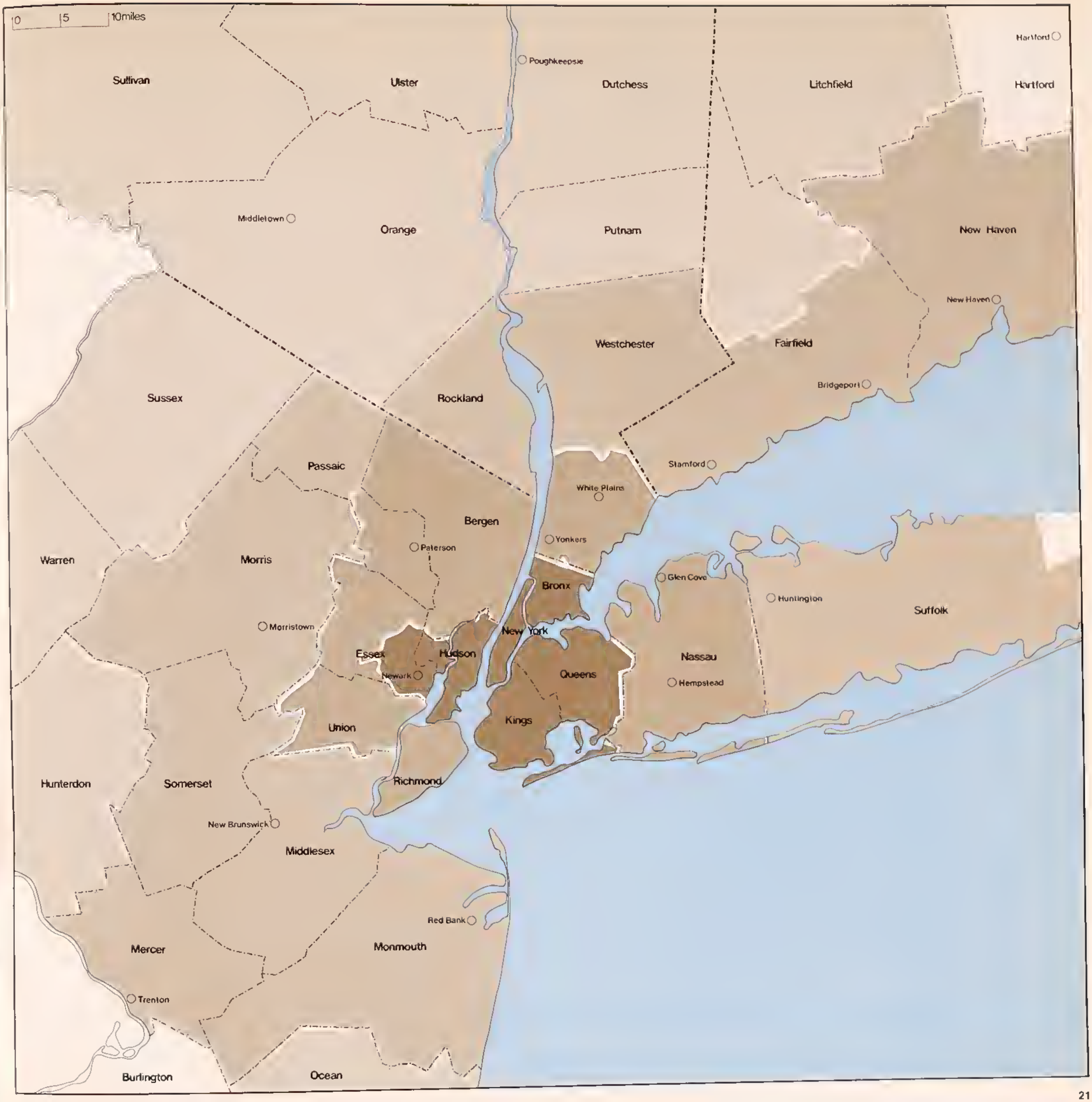
(c) Monmouth, Mercer, Middlesex, Somerset, Morris and Passaic Counties in New Jersey; Rockland, Westchester and Suffolk Counties in New York; New Haven and Fairfield Counties in Connecticut.

(d) Ocean, Hunterdon, Warren and Sussex Counties in New Jersey; Orange, Sullivan, Ulster, Dutchess and Putnam Counties in New York; and Litchfield County in Connecticut.

Source: **The Region's Growth,** Regional Plan Association, May 1967, Table 30; **Projections for the New York Urban Region's 31 Counties—1985, 2000,** July 10, 1973, Tables 1, 16 and 17.

Illustration 4 Areas of Growth in the New York Region

▨	Core Area
▨	Inner Ring
▨	Intermediate Ring
▨	Outer Ring
- - - - -	County Line
-·-·-·-	State Line
⊕	North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Westchester
Fairfield
Sussex
Rockland
Bridgeport
Passaic
Stamford
White Plains
Bergen
Yonkers
Paterson
Warren
Morris
Bronx
Glen Cove
Huntington
Suffolk
Morristown
New York
Essex
Hudson
Queens
Nassau
Newark
Hempstead
Kings
Union
Hunterdon
Somerset
Richmond
New Brunswick
Middlesex
Red Bank
Mercer
Monmouth
Trenton
Burlington
Ocean

The next area outward—consisting of the counties of Nassau, Bergen, Essex, Union, Richmond, Passaic and Westchester—absorbed nearly half of all the region's growth in population between 1940 and 1960. Between 1960 and 1970, over half of the region's growth occurred beyond even these areas. Given the relatively small proportions of regional population in the outer areas, and the relatively large amounts of vacant land there, this trend of growth away from the center is expected to continue.

Employment is generally divided into manufacturing and service, or non-manufacturing, categories. Like other urban areas of the country, the New York region has experienced a steady decrease in manufacturing jobs and increase in service jobs. In 1970, the RPA found that the breakdown of jobs for the region was 77 percent service and 23 percent manufacturing. They foresee this trend continuing, so that by the year 2000 the regional proportions will be 86 percent service and 14 percent manufacturing. (See Table 3.)

Table 3 Total Employment and Manufacturing Employment in the New York Region
Numbers in Thousands

	1960	1970	2000
Total Employment	7,333	8,624	11,800
Manufacturing	2,201	1,966	1,700
Manufacturing as Percent of Total	29	23	14

Source: **Projections for the New York Urban Region's 31 Counties—1985, 2000,** Regional Plan Association, July 10, 1973, Table 16; and Regional Plan Association, **New Regional Projections: A Summary,** March 1973, pp. 9 and 10.

Similarly, the trend from blue-collar to white-collar jobs in the region is expected to continue. The balance in the New York region had tipped by 1955. A doubling of white collar jobs by the end of this century is predicted, while blue-collar jobs are seen as rising by only about 13 percent. Significantly, the bulk of the new jobs are expected to locate far from the center of the region. Thus, the center's share of both regional employment and population is predicted to decrease between now and the year 2000.

Today, the Manhattan CBD still remains the leading location for corporate headquarters within the region. However, there has been considerable movement of firms from Manhattan to other parts of the region, and this trend is continuing. Only a small portion of this relocation has been to areas outside the region, which seems to indicate a continuing corporate prominence for the region.

In terms of transportation, there are about 1500 miles of expressway in the TSRPC region. About 85 percent of the regional travel is on highways, and in this respect the New York region resembles other metropolitan areas of the country. But travel to and from Manhattan is overwhelmingly by public transportation. Of an estimated 4.1 million daily person-trips to Manhattan in 1963, only 13 percent were by auto drivers and auto passengers.

Probably the most striking physical feature of the region is New York Harbor. Located at the mouth of the Hudson, this huge natural harbor is protected from the Atlantic by the islands which form most of New York City. In fact, the harbor was a major reason for the original establishment of the city, and has played a key role in its patterns of living and working throughout its history.

Illustration 5 The Highway Network in the New York Region

■ Interstate Highway

▨ Non-Interstate Highway

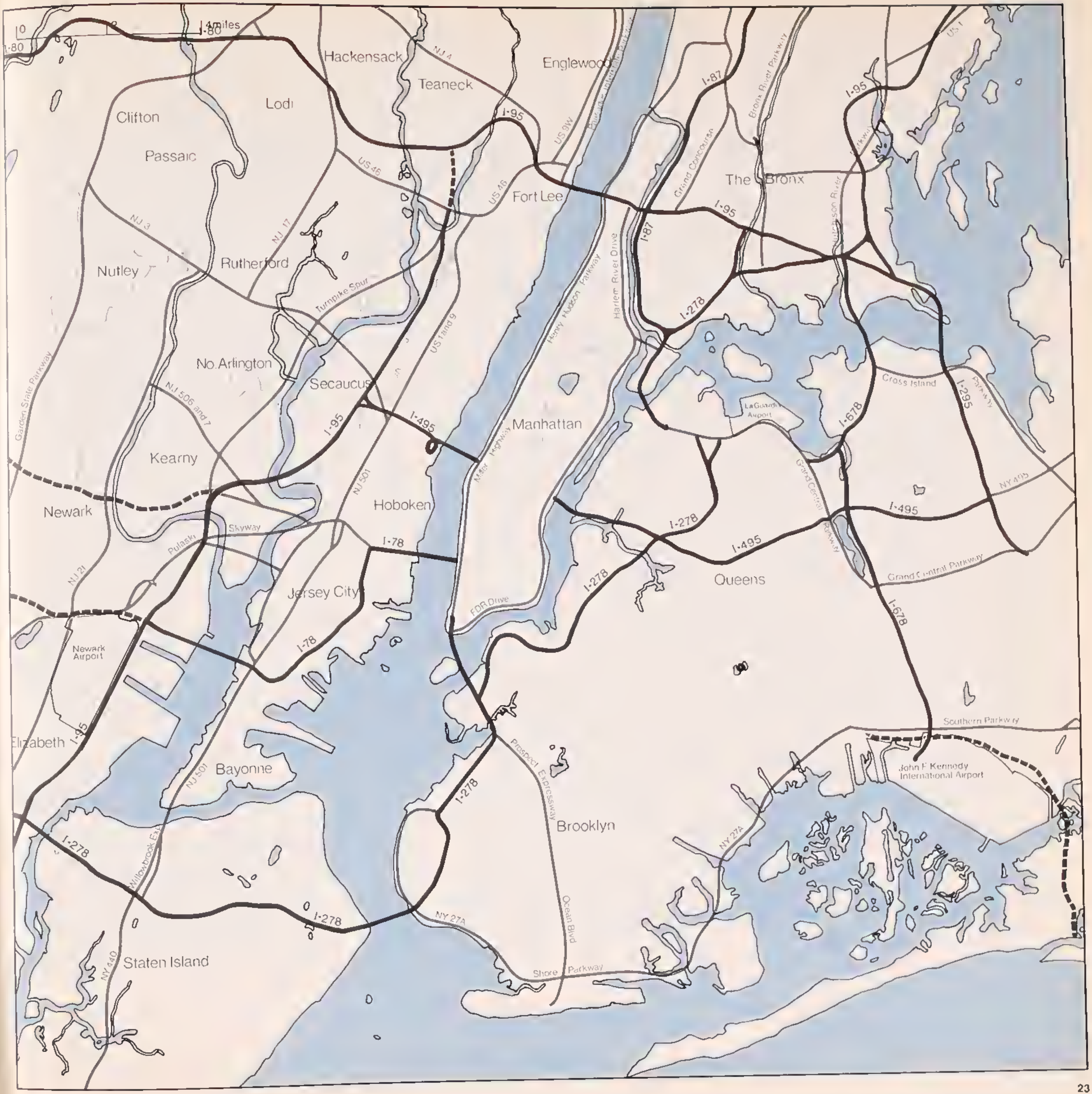
↑ North

Manhattan

The hub of the New York region is the Borough of Manhattan. It measures 13 miles in length and occupies a land mass of 22.7 square miles. The physical size of Manhattan understates its pre-eminence as an urban center. The Island houses nearly 8 percent of the region's population and provides 12 percent of its floor space and 30 percent of its jobs. Numbered among its inhabitants are some of the wealthiest and some of the poorest citizens of the country. Dozens of diverse business and residential communities are crowded together here. Business is conducted in structures which range from the new 110-story World Trade Center towers to industrial loft buildings more than 100 years old. The population is representive of most nations of the world. The diversity and vitality of Manhattan contribute significantly to the strength of the New York metropolitan area. Manhattan is a national and international center for the arts, and the corporate and financial worlds, as well as a crossroads for trade and communications. Thus, it has significance far beyond that of being New York City's Central Business District.

The fact that Manhattan is an island has important implications for its economic and transportation activities. Manhattan is bordered on the south by the extensive and well-protected natural harbor of New York Bay, on the west by the broad Hudson River, and by the Harlem and East Rivers along its northern and eastern sides.

However, the size and shape of the Island have not remained the same all during the city's history.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Englewood
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Bronx River Parkway
US 1
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Clifton
Lodi
I-95
Passaic
US 9W
Grand Concourse
The Bronx
Hutchinson River Parkway
US 46
US 46
Fort Lee
I-95
NJ 3
NJ 17
I-87
Nutley
Rutherford
Henry Hudson Parkway
Harlem River Drive
Turnpike Spur
I-278
US 1 and 9
No. Arlington
Garden State Parkway
Secaucus
NJ 506 and 7
Cross Island Parkway
I-295
LaGuardia Airport
I-495
I-678
Manhattan
I-95
Major Deegan Highway
Kearny
Grand Central Parkway
NY 495
NJ 501
Hoboken
I-495
Newark
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Pulaski Skyway
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I-78
NJ 21
I-278
Jersey City
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Grand Central Parkway
FDR Drive
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Newark Airport
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Prospect Expressway
Elizabeth
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Bayonne
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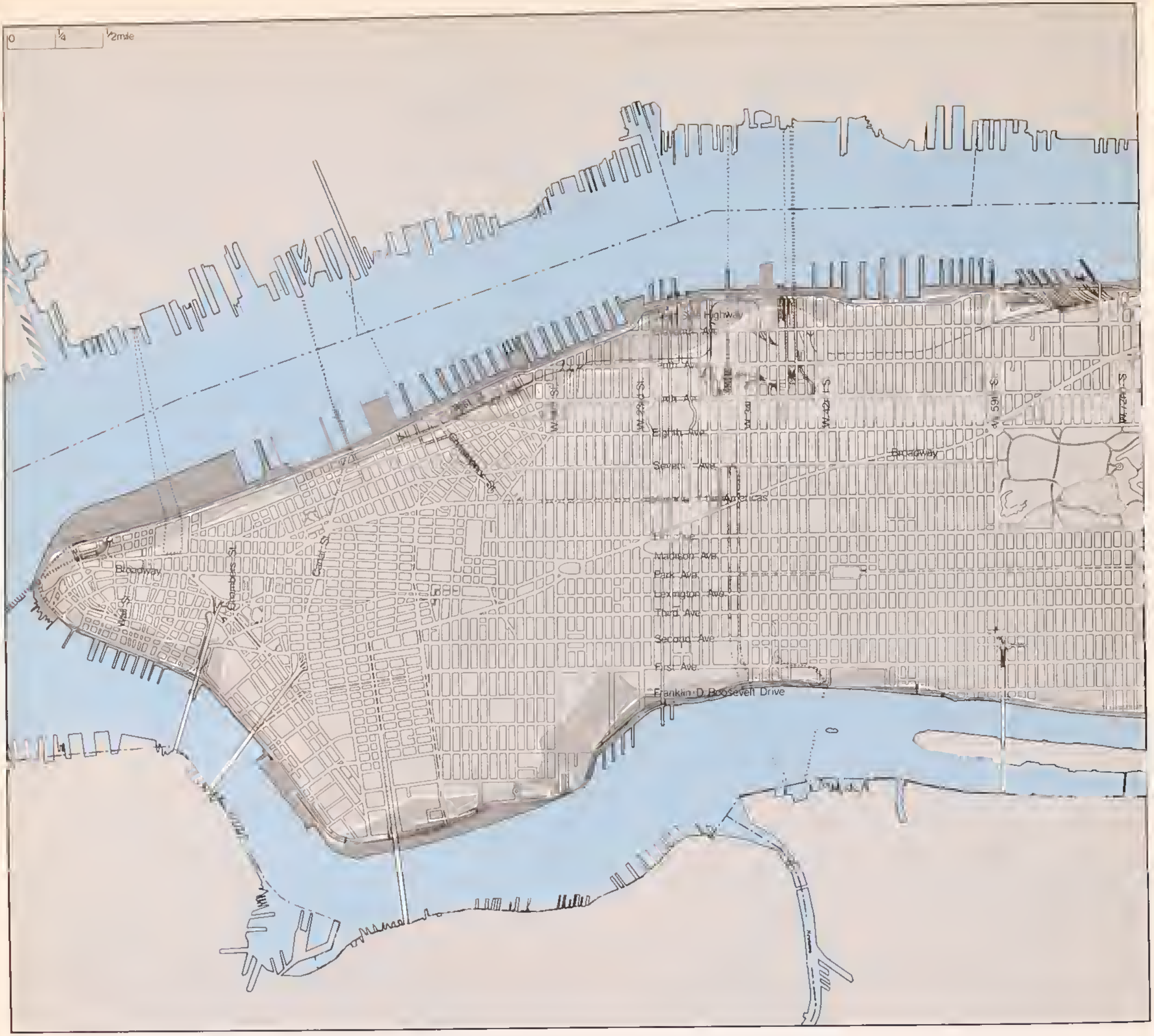
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Lexington Ave
Third Ave
Second Ave
First Ave
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W 42nd St
W 59th St
W 72nd St
West St
Canal St
Chambers St
Wall St
Broadway

Illustration 6 **Expansion of Manhattan Island Since 1650**

▭ Area of Manhattan in 1650

▨ Area Added Between 1650 and 1874

■ Area Added Between 1874 and 1974

North

Periodically, since the original settlement of Manhattan by the Dutch, its area has been increased and its shoreline altered by a series of landfills, along both rivers and at the southerly tip of the Battery. (See Illustration 6.) Originally, the southern tip of the Island was at Bowling Green, where the United States Customs House now stands. The eastern boundary below 50th Street went along First Avenue and Pearl Street. On the West Side, Manhattan originally extended below Canal Street only to Greenwich Street, then along Washington Street up to 14th Street, then along 10th Avenue as far as 23rd Street, and along 11th Avenue beyond that. Manhattan's present boundaries generally have been established for about 100 years, except for alterations by projects which are currently under way along both the Hudson and East Rivers.

The factors which made Manhattan the focus of a flourishing world port, the extensive shoreline and protected position, have in more recent times worked against it by serving to isolate it from the land masses to the north and west. Thus, there are no natural land connections between Manhattan and the North American mainland. This was not critical in the days when water transport was the predominant mode for moving cargo, and when the Island itself was the ultimate origin and destination for a substantial share of the goods and materials being moved.

However, the emergence of the railroad era forced some adaptations in order to maintain the freight movements necessary for a viable Manhattan economy. Rather than bridging the broad lower Hudson, the railroads developed the "carfloat" operation, in which rail cars are loaded onto barges at the New Jersey railroad terminals on the western side of the river and floated across to Manhattan, where they are either loaded or unloaded at the piers, or are brought ashore and transferred by rail to terminal facilities. This operation imposes additional time and costs upon rail movements to and from Manhattan.

Only one direct rail freight link to Manhattan from the north or west was ever constructed. This is the former New York Central's railroad bridge which crosses the Harlem River at Spuyten Duyvil. This bridge carries the line running north along the east bank of the Hudson to a major junction at Albany, where it connects to the extensive rail system extending westward, now controlled by the Penn Central Railroad. This line is still in operation. Thus, the only direct rail freight link to Manhattan from the west requires trains to travel about 140 miles out of their way to the north, with additional costs and time.

Over the years, a number of passenger rail links to Manhattan have been established. The commuter rail lines running north and east are an established part of the Island's life style. In addition, there are two passenger railroad tunnels under the Hudson, carrying the Port Authority Trans Hudson (PATH) commuter line and a Penn Central main line connection.

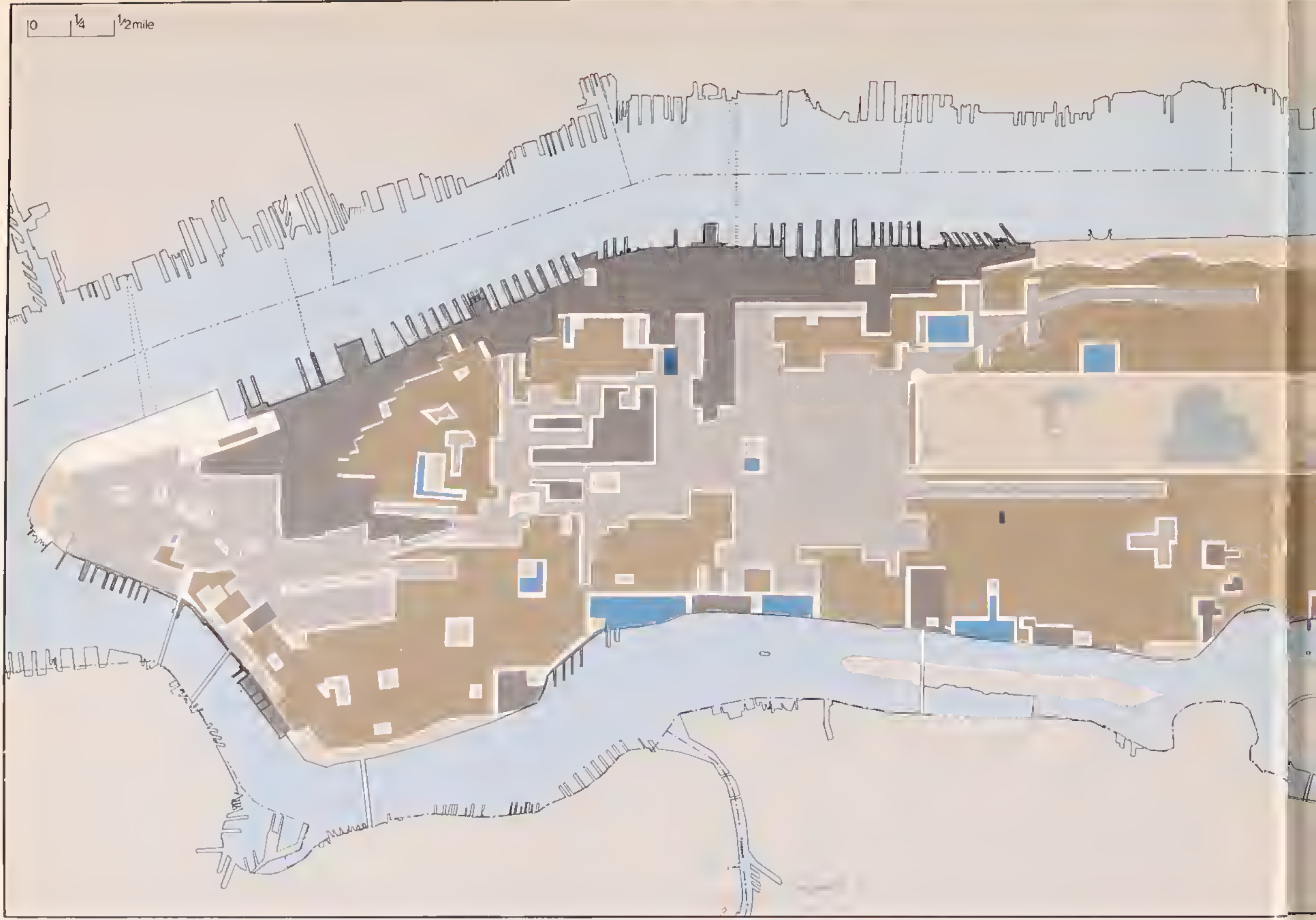
Manhattan is connected to New York City's other boroughs and to New Jersey by 20 motor vehicle links —16 bridges and 4 tunnels. These limited water crossings constrain the movement of both people and freight to and from Manhattan.

Looking at land use, Manhattan customarily is divided along an east-west line drawn across 59th Street, just below the Island's midpoint at the southerly end of Central Park. To the north of 59th Street, medium to high density apartment houses predominate, indicative of the fact that about 90 percent of the Island's housing is rented rather than owned. This area surrounds, on three sides, the 840-acre Central Park.

The nine square miles to the south of 59th Street is area commonly defined as the CBD. The bulk of Manhattan's commercial uses and activities are found in this southerly half of the Island. The CBD itself is composed of two distinct and high-intensity commercial areas, each with its own familiar cluster of skyscrapers. Midtown, between 30th and 59th Streets, includes the major department stores and shopping streets, the Garment Center, the Theater District, the United Nations, hotels and restaurants, and block after block of large office buildings, including the Empire State Building and Rockefeller Center. Intermixed in this area are also many apartment buildings and residential areas, especially on the East Side.

Separated by about two miles is the Downtown section, known as Lower Manhattan. This occupies the southern tip of the Island, from Battery Park north to around the Brooklyn Bridge, where the Civic Center houses City, State and Federal offices. The city's financial community is located here, along and around Wall Street. The picture-postcard view of huddled skyscraper and narrow canyons is now dominated by the Port Authority's new World Trade Center. Lower Manhattan houses almost no permanent residents, but several new housing developments are either under way or proposed for the area.

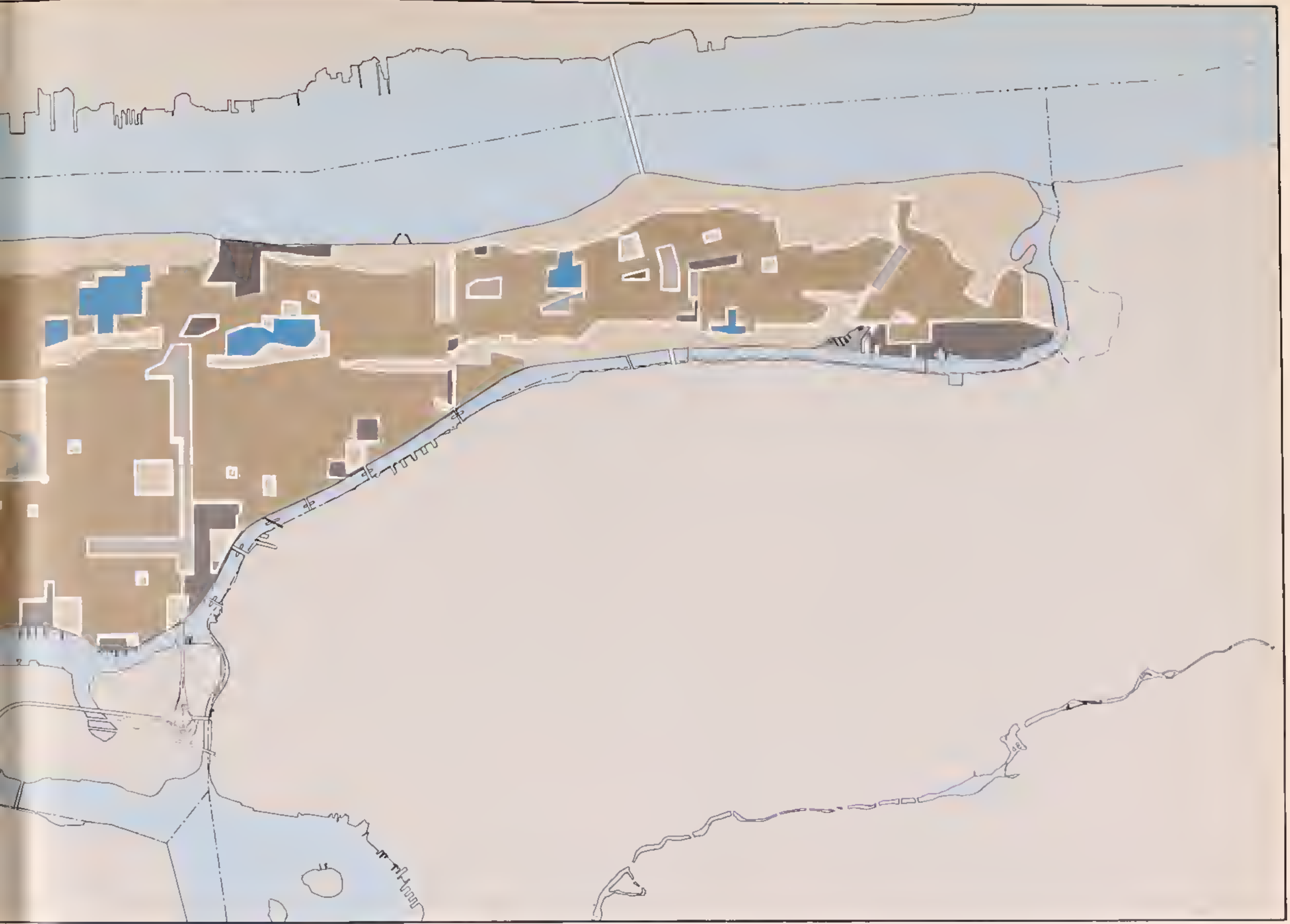
The growing Manhattan skyline seen from New York Bay contrasts with a deteriorating Hudson River pier on the West Side.



Between Midtown and Lower Manhattan are a variety of residential and commercial communities. Characterized by low-rise buildings which visually separate Midtown and Downtown, they are collectively referred to as the "Valley." Just south of Midtown, between 30th and 14th Streets, residential neighborhoods on both the East and West Sides are separated by an important manufacturing loft district located near the center of the island. Chelsea, on the West Side, is an old historic community now undergoing fairly extensive renovation, while the East Side area is well known for its select neighborhoods surrounding Stuyvesant Square and Gramercy Park. Just north of Downtown, between Canal and 14th Streets, are the Greenwich Village and Lower East Side neighborhoods. These contain high to medium density residences surrounded by commerce and light industry. The lower East Side is particularly noted for its numerous ethnic neighborhoods.

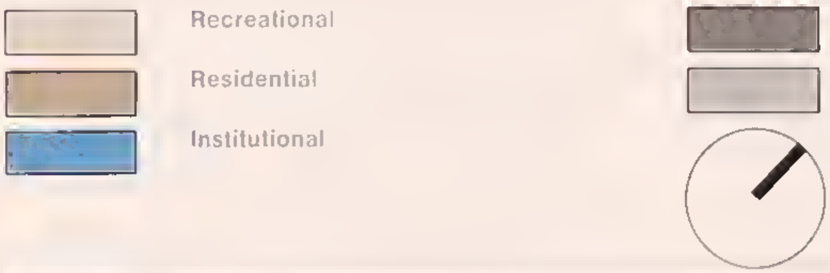
Until recent years, the keystone of New York City's economy was manifested in its West Side piers. The scores of piers jutting out into the Hudson River for five miles between the Battery and 60th Street collectively constituted one of the best known Manhattan landmarks. Shipping and attendant commercial activities loomed large in the city's economy for well over a century, from the completion of the Erie Canal in 1825 through the 1950's. Typically, the West Side piers would be full of ships, loading and unloading both cargo and people. The teeming activity would include railroading, trucking and warehousing arrayed in a band of land adjacent to the piers. Shipping and related business at one time provided the largest single source of employment in the City.

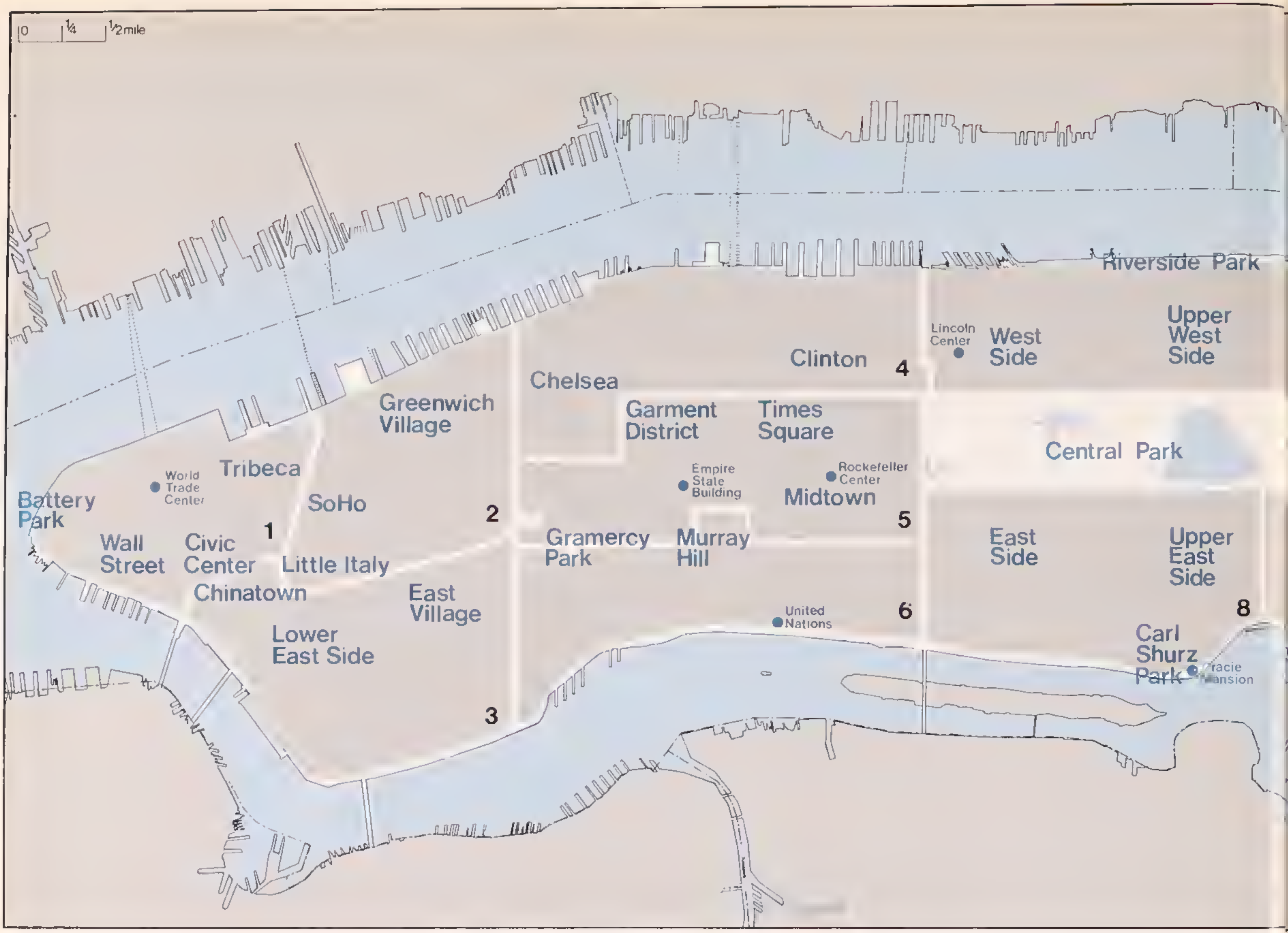
However, over the last 15 years, while other parts of the Port of New York have grown, mainly in New Jersey, cargo shipping has all but disappeared from Manhattan. Only four of the remaining West Side piers are still used at all for shipping, and only one of those for cargo shipping. This dramatic change is explained in full in the following section on the Waterfront.



Most of the piers are idle and decaying. Many have been demolished or destroyed by fire. Others are used as inexpensive storage space by various public agencies so long as they remain structurally sound. Aside from the significance of this change in the city's economy, it has had a major physical impact. It has left a large and valuable area along the Hudson River very much underutilized, and even deserted and decaying in parts. This is the area through which runs the existing West Side Highway, and which constitutes the study area for this Project.

Illustration 7 Present Land Uses in Manhattan





Population

Manhattan's resident population declined significantly by 13.4 percent between 1950 and 1960, followed by another drop of 9.4 percent between 1960 and 1970.[4] The 1970 population was reported at nearly 1.54 million, accounting for 7.8 percent of total regional population, down from a 9.6 percent share in 1960. (See Table 4.) Yet, Manhattan's density remains in excess of 70,000 persons per square mile. The population of Manhattan has always been representative of many ethnic backgrounds; however, the racial composition of the population is undergoing a change. The 1970 Census indicated that births have declined sharply for the White population and are increasing for Blacks and Puerto Ricans.

Project population estimates for 1995 for Manhattan are shown for a minimum and a moderate range, each based upon different assumptions for changes in population and employment growth projections between now and 1995.[5] Under the Project's minimum projection, population would drop to 1.4 million, slightly below the present level of 1.5 million, which would decrease Manhattan's share of projected regional population to 5.9 percent. Under the Project's moderate projection, the decline would be slightly less, to 1.46 million, representing 6.1 percent of regional population.[6]

Both projections indicate a continuation of the decline in population experienced over the past years, but at lower rates of decline. In addition, internal shifts in Manhattan's population are expected, with an increase

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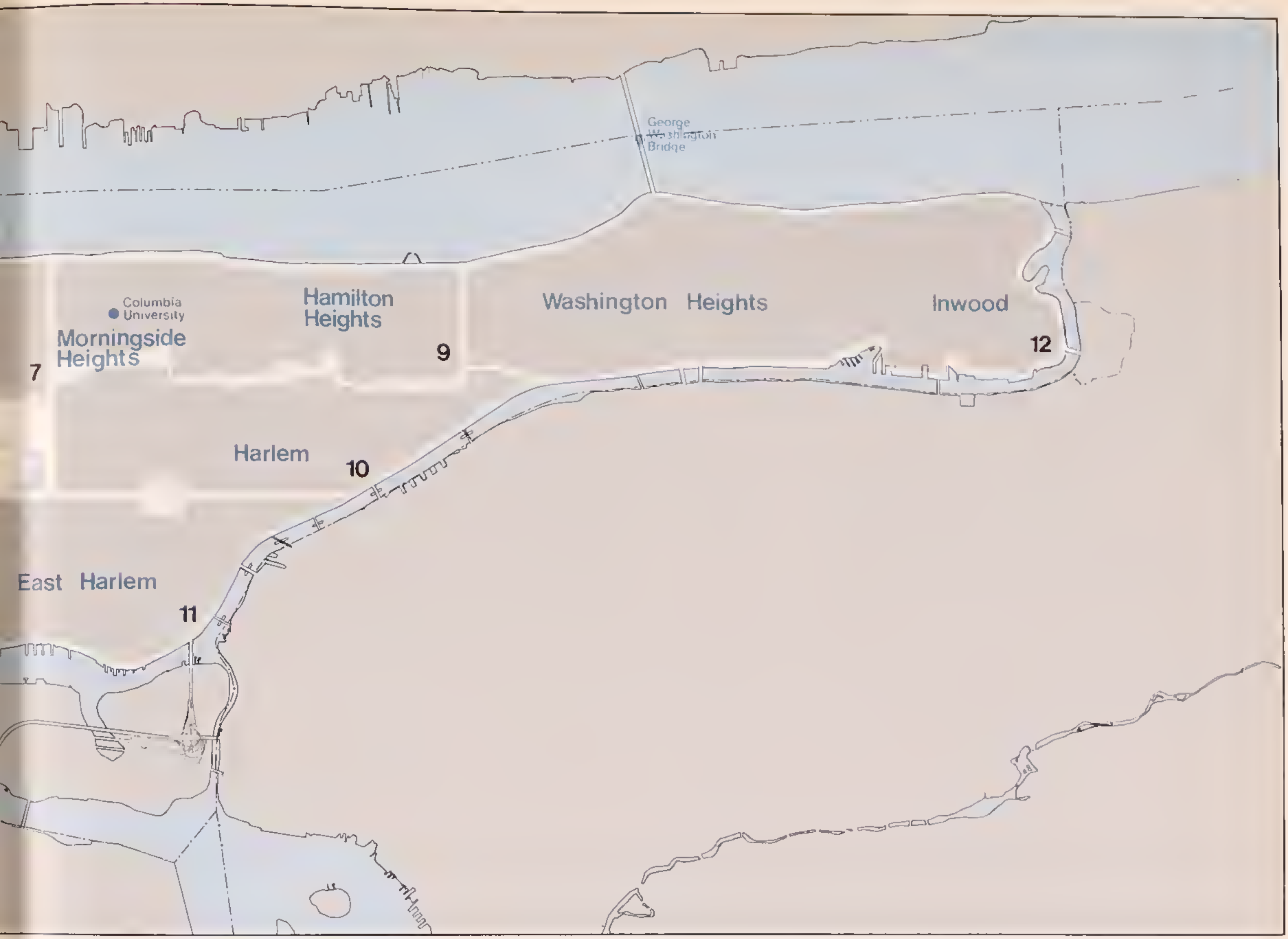
[4] Sources for population data for 1960 and 1970 are United States Censuses of Population, unless otherwise noted.

[5] For a discussion of these growth assumptions, see West Side Highway Project Report No. 5.11, **Forecasting Methodology and Resulting Floor Area and Demographic Estimates For Use in Traffic Assignment Process,** February 1973.

[6] The Tri-State Regional Planning Commission estimates "zero" population growth to 1995; the New York City Planning Commission projects a moderate decline to 1.45 million between now and 1995.



in CBD residents, but a decrease in people living north of the CBD. Redevelopment and relief of overcrowding north of 59th Street may reduce total population in that area from 974,000 in 1972 to a range of 840,000 to 860,000 in 1995 under the moderate and minimum projections, respectively. New residential growth south of 59th Street should result in a net increase in population from 520,000 in 1972 to 544,000 in 1995 under the minimum projections, or to 615,000 under the moderate projection series.

A significant population trend is the decreasing size of households. Although total population in Manhattan declined by 9.4 percent between 1960 and 1970, the number of households decreased by only a modest 1.3 percent (696,000 to 687,000). The relatively small percentage decline in total households was due to the fact that median household size dropped from 2.36 persons in 1960 to 2.17 persons in 1970. The trend toward smaller household size reflects the tendency of one and two person households to choose a high density urban environment while larger households continue to leave the urban core seeking the additional space and amenities that the City cannot provide at an acceptable cost.

A continuation of this trend towards smaller size households is projected. By 1995, household size is anticipated to decrease to an average of 2.0 persons for total Manhattan, and to 1.85 for the Manhattan CBD, as compared to a somewhat larger size for the Region.

Illustration 8 Neighborhoods and Community Planning Districts in Manhattan

▨	Community Planning District Areas
●	Selected Landmarks
↗	North

Table 4 Population in Manhattan and the New York Region
Numbers in Thousands

Area	1960	1970	1972	1995 Minimum(b)	1995 Moderate(c)
Manhattan CBD	546	505	520	544	615
Rest of Manhattan	1,152	1,034	974	860	840
Total Manhattan	1,698	1,539	1,494	1,404	1,455
New York Region(a)	17,624	19,752	NA	23,900	23,900
Manhattan as Percent of Region	9.6	7.8	–	5.9	6.1

Change	1960-70		1970-72		1972-95 Minimum(b)		1972-95 Moderate(c)	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Manhattan CBD	–41	–7.5	15	3.0	24	4.6	95	18.3
Rest of Manhattan	–118	–10.2	–60	–5.8	–114	–11.7	–134	–13.8
Total Manhattan	–159	–9.4	–45	–2.9	–90	–6.0	–39	–2.6
New York Region(a)	2,128	12.1	NA	–	NA	–	NA	–

NA: Not Available.

(a) The New York Region consists of New York City and 26 surrounding counties in Connecticut, New Jersey, and New York.

(b) West Side Highway Project Growth Assumption "B," projecting minimum change between 1972 and 1995.

(c) West Side Highway Project Growth Assumption "C," projecting moderate change between 1972 and 1995.

Source: 1960 and 1970 Censuses of Population, for total Manhattan and the Region; 1972 and 1995 estimates for Manhattan and Manhattan CBD by West Side Highway Project, based on a continuation of current trends as projected by Regional Plan Association and Tri-State Regional Planning Commission; all other estimates by West Side Highway Project, as interpolated from the year 2000, based on Regional Plan Association, **New Regional Projections: A Summary**, March 16, 1973.

Under the Project's minimum population projection for 1995, there would be an estimated 1,404,000 persons living in Manhattan–1,374,000 in housing units and 30,000 in group quarters. Thus, with an estimated average household size of 2.0, the number of households would total 687,000 under the minimum projection, a figure comparable to that in Manhattan in 1970. Under the Project's moderate population projection, assuming the same population in group quarters and the same average household size, total 1995 households are estimated at 713,000, a gain of 35,000, or 5.2 percent over the 23-year period 1972 to 1995. (See Table 5.) Between 1972 and 1995, it is anticipated that the Manhattan CBD will experience a rise in number of households under both the minimum and moderate population projections–gains of 26,000 and 65,000 respectively. The remainder of Manhattan, north of the CBD, will probably have a continuous loss of households over the projection period. In terms of housing, this continuing trend to smaller households implies a need for a larger number of dwelling units in Manhattan in 1995 than would be suggested by the projected continuing decrease in population.

The economic resources of Manhattan's residents increased over the past decade as reported by the United States Census. Median family income increased from $5,338 in 1959 to $8,983 in 1969. The range of income is particularly wide. Nearly one-quarter of the Manhattan families have incomes under $5,000, and a substantial number of persons earn less than $3,000 annually. At the same time, Manhattan has well over 36 percent of the City's families with incomes of $25,000 or more. The proportion of middle income families is smaller than in any other borough. The trend toward higher family income is expected to continue through 1995.

The highly dense character of the housing supply in Manhattan is unique in the Region. Over 97 percent of the Island's housing units are in structures containing five or more units. Moreover, nearly half of the housing supply exists in structures of 50 or more units.

Manhattan has the city's oldest housing stock; nearly two-thirds was built prior to 1939. The total housing supply reported by the 1970 Census was 714,000 units, including those in poor condition or unavailable for occupancy. Between 1960 and 1970, there was a net decline of 13,000 units, despite additions of some 100,000 dwelling units during this time. Although total population dropped by ten percent, the number of households decreased by only 1.3 percent. Therefore, the 1.8 percent net loss of units exceeded the decrease in households.

Rental occupancy accounted for 93 percent of all units in 1970. Owner-occupancy, although only a fraction by comparison, nearly doubled between 1960 and 1970, primarily due to the recent wave of conversion to and construction of cooperatives. The increasing mobility of the population suggests a continued demand for rental occupancy.

Table 5 **Households and Household Income for Manhattan**

Numbers in Thousands

	1960	1970	1972	1995	1995	Change 1960-70		Change 1970-72		Change 1972-95		Change 1972-95	
				Minimum(b)	Moderate(c)					Minimum(b)		Moderate(c)	
						Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total Manhattan													
Population	1,698	1,539	1,494	1,404	1,455	– 159	– 9.4	– 45	–2.9	– 90	– 6.0	– 39	– 2.6
In Group Quarters	57	45	43	30	30	– 12	–21.1	– 2	–4.4	– 13	–30.2	– 13	–30.2
In Households	1,641	1,494	1,451	1,374	1,425	– 147	– 9.0	– 43	–2.9	– 77	– 5.3	– 26	– 1.8
Households	696	687	678	687	713	– 9	– 1.3	– 9	–1.3	9	1.3	35	5.2
Average Household Size	2.36	2.17	2.14	2.00	2.00	–0.19	–	– 0.3	–	–0.14	–	–0.14	–
Average Household Income(a)	–	10,554	12,150	18,575	18,575	–	–	1,596	15.1	6,425	52.9	6,425	52.9
Manhattan CBD													
Population	546	505	520	544	615	– 41	– 7.5	15	3.0	24	4.6	95	18.3
In Group Quarters	23	19	19	14	14	– 4	–17.4	0	–	– 5	–26.3	– 5	–26.3
In Households	523	486	501	530	601	– 37	– 7.1	15	3.1	29	5.8	100	20.0
Households	245	249	260	286	325	4	1.6	11	4.4	26	10.0	65	25.0
Average Household Size	2.13	1.95	1.93	1.85	1.85	–0.18	–	–0.02	–	–0.08	–	0.08	–
Average Household Income(a)	–	10,157	11,900	19,175	19,175	–	–	1,743	17.2	7,275	61.1	7,275	61.1

(a) Household income data are for 1969.

(b) West Side Highway Project growth Assumption "B," projecting minimum change between 1972 and 1995.

(c) West Side Highway Project growth Assumption "C," projecting moderate change between 1972 and 1995.

Source: 1960 and 1970 Censuses of Population and Housing; 1972 and 1995 population estimated by West Side Highway Project, based on a continuation of current trends as projected by Regional Plan Association and Tri-State Regional Planning Commission, other estimates by West Side Highway Project based on extrapolation of trend data.

Table 6 Nonagricultural Employment Trends for Manhattan
Numbers in Thousands

Industry Group	1960	1970	1971	Change 1960-70		Change 1970-71	
				Number	Percent	Number	Percent
Total Nonagricultural Employment	2,548.0	2,589.4	2,428.2	41.4	1.6	–161.2	6.2
Wage and Salary	2,274.1	2,383.1	2,228.7	109.0	4.8	–154.4	– 6.5
Manufacturing	523.5	417.3	381.4	–106.2	–20.3	– 35.9	– 8.6
Nonmanufacturing	1,750.6	1,965.8	1,847.3	215.2	12.3	–118.5	– 6.0
Mining	1.9	1.9	1.7	0.0	–	– 0.2	–10.5
Contract Construction	67.7	53.1	55.3	– 14.6	–21.6	2.2	4.1
Transportation and Public Utilities	215.3	187.5	169.3	– 27.8	–12.9	– 18.2	– 9.7
Wholesale and Retail Trade	489.4	457.0	429.6	– 32.4	– 6.6	– 27.4	– 6.0
Wholesale Trade(a)	240.8	228.0	213.1	– 12.8	– 5.3	– 14.9	– 6.5
Retail Trade	248.6	229.0	216.5	– 19.6	– 7.9	– 12.5	– 5.5
Finance, Insurance, and Real Estate	324.0	400.8	388.4	76.8	23.7	– 12.4	– 3.1
Services and Miscellaneous	467.5	611.1	545.2	143.6	30.7	– 65.9	–10.8
Government	184.8	254.4	257.8	69.6	37.7	3.4	1.3
All Others	273.9	206.3	199.5	– 67.6	–24.7	– 6.8	– 3.3
Total Manufacturing and Wholesale Trade	764.3	645.3	594.5	–119.0	–15.6	– 50.8	– 7.9
Total Manufacturing and Wholesale Trade as							
Percent of Total Nonagricultural Employment	30.0	24.9	24.5				

(a) Estimated by West Side Highway Project, based on percentage distribution of wholesale trade for each year as reported for covered employment by the New York State Department of Labor.

Source: Tri-State Regional Planning Commission, Socio-Economic Systems Section.

Employment

Despite the drastic decline of shipping, Manhattan remains the heart of the regional economy. The CBD contains 28 percent of the Region's jobs. Most of the employment is concentrated in the CBD's two commercial centers—Lower Manhattan and Midtown. The activities in which the New York metropolitan region plays a major role—finance, insurance, corporate headquarters, communications, foreign trade, wholesaling, apparel, printing, and entertainment—are located in the Manhattan CBD.

Manhattan currently provides 2.47 million jobs. This level remained almost constant between 1960 and 1970, rising by a mere 1.6 percent. However, during that decade, there was a significant shift in types of jobs—with a drop in manufacturing and wholesaling, and a rise in services and office work. High land cost, high labor costs and transportation difficulties, as well as other factors, have decreased the advantages of Manhattan locations for manufacturers, so much so that many left the borough for other parts of the City or the Region. During this period, manufacturing experienced a sizeable loss of 106,200 jobs, or 20 percent, and wholesale trade employment had a loss of 12,800, or five percent. These two industry groups, therefore, declined significantly as a proportion of total employment, falling from a 30 percent share in 1960 to 24.9 percent in 1970. This was more than offset by the gains of 143,600 in services and 76,800 in the finance, insurance and real estate categories. (See Table 6.) Government jobs also increased over this ten-year period, showing a gain of 69,600, or 38 percent.

1972 to 1995 Projections Employment in Manhattan is expected to increase slightly over the 1972 to 1995 period under both the Project's minimum and moderate projection series. Both projections assume that manufacturing and wholesale trade employment will continue to decline, then level off near the end of the period; these declines would be more than offset by gains in the office and service sectors of the economy.[7]

Under the minimum projection, the total employment in Manhattan would rise from 2,473,000 in 1972 to 2,583,000 in 1995, a gain of 110,000, or 4.4 percent, and would nearly approximate the 1970 employment level in Manhattan. Under this projection series, Manhattan employment would account for 22.8 percent of total employment in the region, down from its 30.1 percent share in 1970. The CBD, reinforcing its position as the dominant employment area of the borough, would add 140,000 jobs over this period, while the remainder of Manhattan would show a decrease of 30,000. (See Table 7.)

Table 7 Employment in Manhattan and the New York Region
Numbers in Thousands

	1970	1972	1995(a) Minimum(b)	1995(a) Moderate(c)
Manhattan CBD	2,229	2,122	2,262	2,373
Remainder of Manhattan	360	351	321	321
Total Manhattan	2,589	2,473	2,583	2,694
New York Region	8,600	NA	11,350	11,350
Manhattan as Percent of Region	30.1	–	22.8	23.7

Change	1970-72		1972-95 Minimum(b)		1972-95 Moderate(c)	
	Number	Percent	Number	Percent	Number	Percent
Manhattan CBD	–107	–4.8	140	6.6	251	11.8
Remainder of Manhattan	– 9	–2.5	–30	–8.5	–30	8.5
Total Manhattan	–116	–4.4	110	4.4	221	8.9
New York Region	NA	–	NA	–	NA	

NA: Not Available

(a) 1972 and 1995 figures are estimated.

(b) West Side Highway Project Growth Assumption "B," projecting minimum change between 1972 and 1995.

(c) West Side Highway Project Growth Assumption "C," projecting moderate change between 1972 and 1995.

Source: 1970 for Total Manhattan and New York Region, Connecticut, New Jersey, and New York State Departments of Labor; 1972 and 1995 for Manhattan, estimated by West Side Highway Project; 1995 for region, estimated by West Side Highway Project, interpolated from data in the Regional Plan Association report, **New Regional Projections: A Summary**, March 16, 1973.

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[7] Estimated by West Side Highway Project, based on an analysis of Regional Plan Association and Tri-State Regional Planning Commission trends and projections. See Note 5.

Under the moderate projection, which assumes a slightly faster rate of growth in office and service employment, total employment in Manhattan would rise to an estimated 2,694,000 persons, a gain of 221,000, or 9 percent. This would represent 23.7 percent of total regional employment by 1995. All of the increase would be registered in the CBD, where total employment is anticipated to rise to 2,373,000. The non-CBD portion is estimated to fall to 321,000 over the 23-year period, the same as under the minimum projection. Thus, the CBD is expected to account for 88 percent of all jobs in Manhattan in 1995, up slightly from its 86 percent share in 1970 and 1972.

According to current RPA projections, a continuing loss of manufacturing and wholesale employment is anticipated for Manhattan, as in the Region as a whole, along with continued growth in the government and service sectors. There are no current RPA employment projections by industry sector for the Manhattan CBD. However, projections for all of Manhattan for 1985 reflect primarily changes in the CBD, which accounted for 86 percent of total Manhattan employment in 1972. RPA estimates that manufacturing jobs in Manhattan will decline by 103,000, or 29 percent over the 1970 to 1985 period. (See Table 8.)

The high cost of space in Manhattan necessitates the use of multi-story structures for manufacturing and other industrial activities. The loft buildings concentrated on Manhattan's West Side generally contain several firms engaged in a variety of light industrial activities. Manufacturing establishments are relatively small; over 70 percent of the borough's plants employ less than twenty persons, a higher proportion than is found in any other industrial area in the Region. Manhattan has over 50 percent of the City's manufacturing employment, and firms average 22 workers per plant as compared to an average of 36 in the other four boroughs.[8] Manhattan's larger manufacturing concerns have been moving out to areas where less costly land is accessible for growth. Those manufacturing firms remaining in Manhattan will be increasingly characterized by their small size and specialized function. The availability of space particularly suited for smaller concerns makes a CBD location more attractive to the newly developing firm due to its proximity to labor and markets. As an establishment reaches the point where additional space becomes too costly, it will most likely follow the movement out to more open areas. Other firms remaining in Manhattan's lofts over time will be industrial concerns such as printing, that are closely tied to the CBD economy.

Table 8 Projected Employment for Manhattan and the New York Region
Numbers in Thousands

	Region		Manhattan		Manhattan as Percent of Region	
	1970	1985	1970	1985	1970	1985
Manufacturing	1,966	1,879	353	250	18.0	13.3
Office	1,851	2,507	976	1,203	52.7	48.0
All other	4,807	5,922	1,227	1,276	25.5	21.5
Total	8,624	10,308	2,556	2,729	29.6	26.5

Source: **Projections for the New York Urban Region's 31 Counties—1985, 2000, Regional Plan Association**, July 10, 1973, Table 18.

Of those manufacturing concerns which remain in Manhattan, an unusually high number are small plants with fewer than 20 employees. It should be noted that 42 percent of the region's plants employing less than 20 people are in Manhattan. Many are of a type which can benefit most from a centralized location, whose services are not normally internalized by companies, such as the printing and publishing industry, which comprises 29 percent of Manhattan's manufacturing employment.

The garment industry accounts for 43 percent of manufacturing employment on the Island. It has been particularly affected in recent years by the out-migration of manufacturers of standardized clothing items. However, Manhattan's strong design, advertising and merchandising complex has retained its attraction for fashion apparel manufacturing.

Office Employment As explained above, the jobs that Manhattan has lost in manufacturing and wholesaling between 1960 and 1970 were replaced in number by the growth in Manhattan office employment. Manhattan's CBD offers firms both the general advantages of urban concentration, and the particular benefits of a location in New York City. Interchange of information and the availability of specialized services, as well as direct communication with the nation's major financial and marketing institutions, provides a strong attraction to white-collar businesses.

Some sources predict that this pattern of increased office jobs for Manhattan will continue. For example, the RPA has recently projected a 35 percent increase in office employment for the region between 1970 and 1985. RPA estimates that over one-third of this increase —227,000 jobs, will occur in Manhattan, of which 225,000 will be in the CBD.

However, there are some indications that the previous pattern of growth in the office industry may in fact be changing for Manhattan. For example, a 1972 study made by The Conference Board, Inc., documents the well known trend of relocating corporate headquarters and other offices out of Manhattan, in most cases to surrounding suburbs, but sometimes altogether out of the New York Region.[9] Further, they concluded that the scope and nature of this phenomenon are peculiar to New York City. Of the 77 firms on Fortune Magazine's list of the top 250 American corporations, which were located in New York City in 1962, 19 had moved out by 1972. This relocation of about 25 percent of the City's largest office firms contrasts with the pattern in other major American cities for similar firms during the same period, in which only about 10 percent relocated. And this does not reflect the substantial moves of lesser company offices out of New York City during the same period, when a company retained some space at a Manhattan address for its nominal headquarters with limited staff.

Further, this trend seems to be continuing. In 1972, the Conference Board found that five more firms on Fortune's list had definite plans to move from the City. Newspaper articles during the life of this Project have identified still more major firms planning to leave Manhattan. The reasons cited by The Conference Board included the normal ones of space cost and availability, and urban problems of crime and taxes.

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[8] **United States Census of Manufacturers**, 1967.

[9] **Corporate Moves to the Suburbs**, The Conference Board, Inc., Report No. 564 (1972).

However, and most pertinent to this Project, several of the reasons cited were related to Manhattan transportation, and the first specific complaint listed was:

"Mass Transportation—companies complain that the city's commuting facilities are antiquated and overcrowded and that frequent equipment breakdowns and traffic snarls cause substantial losses in paid work time."

In addition, better transportation available outside New York City is credited by firms which have moved with both saving time for employees, and making them more productive for the company. The report states that a difference between New York and other major cities which are not experiencing such a loss of offices, like Chicago, is the convenience and reliability of public transportation to the CBD.

An even more recent study which focused just on Lower Manhattan found much the same concern with transportation as a factor affecting office location. This study,which was commissioned by the Downtown Lower Manhattan Association, included interviews with leading area businessmen.[10] Among the problems which they perceived for a Lower Manhattan location were those related to the excessive time, cost and unpleasantness of traveling to and from a Downtown office. In the words of one Downtown executive,

"The least attractive thing about Lower Manhattan is getting in and out of Lower Manhattan."

Both existing mass transit and automobile access were specifically cited as undesirable. Among the actions suggested by the study was the institution of express bus service.

Both of these studies provide contemporary evidence that businesses increasingly are weighing the advantages and disadvantages of Manhattan in making their locational decisions. Inasmuch as both future growth and stability of overall Manhattan employment really depend upon a continuation of the increase in office jobs, factors which affect corporate locational choices become critical to the long-run future of the city's economy. Transportation is one key factor in making the decision whether to move into, remain or move out of Manhattan.

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[10] **Study of Difficulties of Doing Business in Lower Manhattan**, Downtown Lower Manhattan Association (1973).

The Waterfront

The area of Manhattan which is of particular concern to the West Side Highway Project runs along the Hudson River waterfront. This corridor area obviously is closely tied to the River and the Harbor, both geographically and historically. Therefore, this section of the Environmental Impact Statement describes the present physical and economic conditions of the Port of New York as they relate to the West Side of Manhattan, as well as their past evolution and their projected future.

Along the West Side waterfront, there has been a significant decline in maritime commerce over the past 20 years, along with related railroading, trucking and warehousing activities. These activities historically have constituted the overwhelming majority of the land uses along Manhattan's riverfront below 59th Street. Therefore, this significant decline and gradual disappearance have left the five-mile long area with large portions devoted to marginal uses unrelated to the River, and other portions virtually deserted. It is important to appreciate this dramatic change on the West Side in order to evaluate both the area's future potential and the alternative proposals of this Project.[11]

The Port of New York

Looking first to the Port of New York generally, it enjoys a natural and expansive deep water harbor with four separate routes of access from the Atlantic. New York Harbor is really a combination of myriad bays and channels, including the lower Hudson (officially known as the North River), which also constitutes the western boundary of Manhattan, which is one of the many islands in the Harbor. Port facilities have lined both the New Jersey and New York sides of the Hudson.

In terms of ocean cargo, the Port of New York still handles more than any other single port in the country. The Port has shown a steady substantial growth in total tonnage over the past 30 years, handling 22 million tons in 1940 and 54 million tons in 1969. However, during the same period, this Port's share of total United States ocean-borne foreign trade has fallen significantly, from 28 percent in 1940 to less than 13 percent in 1969. This decline relative to other American ports is due to some basic economic facts: (1) some major industries formerly concentrated in the Northeast have shifted to other areas of the country; (2) the Saint Lawrence Seaway has provided a direct deep-water route to major Midwestern cities; (3) rail rates have been changed to the detriment of the Northeast; and (4) New York operating costs have become very high relative to other parts of the country.

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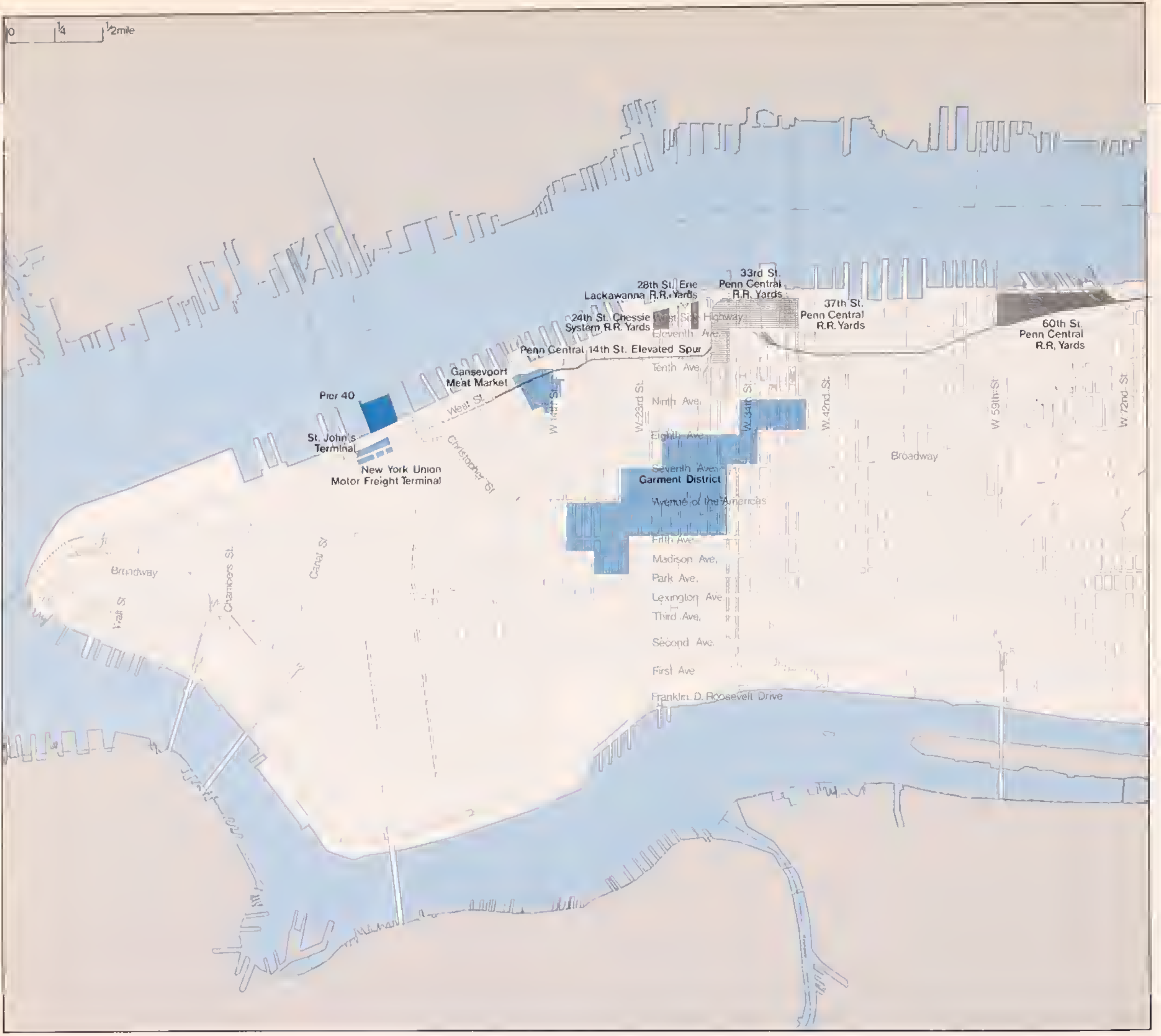
[11] More detailed descriptions of the subjects discussed in this section are available in the following West Side Highway Project reports: **Marine Cargo and Passenger Activities on the West Side of Manhattan**, (No. 5.08, January 1973); **Rail Freight Activities on the West Side of Manhattan**, (No. 5.14, June 1973); **Trucking Activities on the West Side of Manhattan**, (No. 5.15, June 1973).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33rd St.
Penn Central
R.R. Yards
28th St. Erie
Lackawanna R.R. Yards
24th St. Chessie
System R.R. Yards
West Side Highway
37th St.
Penn Central
R.R. Yards
60th St.
Penn Central
R.R. Yards
Eleventh Ave.
Penn Central 14th St. Elevated Spur
Tenth Ave.
Gansevoort
Meat Market
Pier 40
West St.
W 14th St.
W 23rd St.
Ninth Ave.
W 34th St.
W 42nd St.
W 59th St.
W 72nd St.
Eighth Ave.
St. John's
Terminal
New York Union
Motor Freight Terminal
Christopher St.
Seventh Ave.
Garment District
Broadway
Avenue of the Americas
Fifth Ave.
Madison Ave.
Park Ave.
Lexington Ave.
Third Ave.
Second Ave.
First Ave.
Franklin D. Roosevelt Drive
Broadway
Wall St.
Chambers St.
Canal St.

Illustration 9 Shipping, Railroading and Trucking Facilities on the West Side

🟦 Shipping

▩ Railroading

🟦 Trucking

☐ Mixed Railroading and Trucking

⊘ North

In addition, there have been changes in the type of cargo handled here. Almost all of the increase during the past ten years has been in "bulk" cargo (high-volume interchangeable goods like oil), while there has been almost no increase in "general" cargo (manufactured goods of all types). Each requires very different kinds of loading facilities. In 1971, 73 percent of all cargo moved in the Port was bulk in nature, up from 58 percent in 1960. But there are no bulk cargo facilities in Manhattan.

As detailed below, almost all current cargo operations in the Port take place in New Jersey, Brooklyn and Staten Island. Cargo shipping activities have all but disappeared from Manhattan. There is only a single cargo facility still in use on the West Side, which handles a very small and decreasing fraction of the Port's business.

Passenger operations in the Port of New York, while concentrated in Manhattan, have always constituted a small minority of its total shipping activities. Even at the peak of trans-Atlantic travel by sea, there were few passenger ships in the Port relative to cargo ships. During the past 15 years, the Port has shown a 15 percent drop in total ship passengers, with about 740,000 persons arriving and departing in 1971, in about 1100 vessel movements. However, this moderate total decrease disguises a major change in passenger shipping here. There has been a precipitous decline in trans-Atlantic travel, down from 699,000 passengers in 1955 to 165,000 in 1971. This is attributable to the advent of the commercial jet plane. At the same time, there has been a dramatic rise in cruise passengers, up from 184,000 in 1955 to 575,000 in 1971.

The national trends in passenger shipping are expected to continue, with cruises as the mainstay of the business. However, there is divided opinion about the future of cruise traffic in the Port of New York. The optimistic view is that the Port's cruise business will continue to grow at approximately the same rate, due to ongoing investments and improvements in modern passenger facilities here. The pessimistic view sees New York gaining very little of the national growth in cruises, or actually losing passengers. According to this view, cruise business will continue to grow at the southern Florida ports of Miami and Everglades, at the increasing expense of New York. By 1971, the Florida ports had already surpassed New York in cruise passengers, due largely to the advantage of avoiding several days of winter weather at sea.

Whichever prediction proves accurate, there is general agreement that the Port of New York will retain a substantial cruise business, and that the new facilities now being developed by the Port Authority will be sufficient to accommodate that business. But size of the Port's passenger shipping activities must be kept in mind. The Port Authority Consolidated Passenger Ship Terminal will provide nine berths as the Port's total capacity for passenger ships.

Shipping operations today on the West Side are limited to the Midtown passenger piers (above) and Pier 40 (above right).

The West Side Piers

Looking now to the changes which have taken place within the Port of New York, there has been a marked shift of cargo operations from Manhattan to New Jersey, and some to Brooklyn and Staten Island.

The drastic decline in cargo operations on the West Side of Manhattan is reflected in the steady decrease in waterfront hirings over the past 15 years. In 1957-58, the number of Manhattan hirings could provide year-long jobs (250 days/year) for 7,013 men. By 1971-72, the hirings could provide only 1,050 jobs. This decrease of over 85 percent actually understates the situation, as the figures include hirings for passenger as well as cargo operations. Thus, the 1971-72 figure for cargo hirings, if available, would be even smaller. The trend of Manhattan hirings relative to other parts of the Port is shown in Illustration 10.

In addition to high and increasing operating costs in New York City, this shift is due to the changing technology of the industry, and the location of new investment in the Port. While the Port as a whole has increased in efficiency, facilities to accommodate post-war technological advances have been confined to New Jersey, Brooklyn and Staten Island.

During the past decade, the cargo shipping industry virtually has been revolutionized by the development of "containerization." Previously, traditional methods of cargo handling, known as "break-bulk", involved moving individual packages in separate crates on and off ships. Containerization, however, provides shippers with large metal boxes, each about the size of small truck chasses, into which they may pre-pack their own

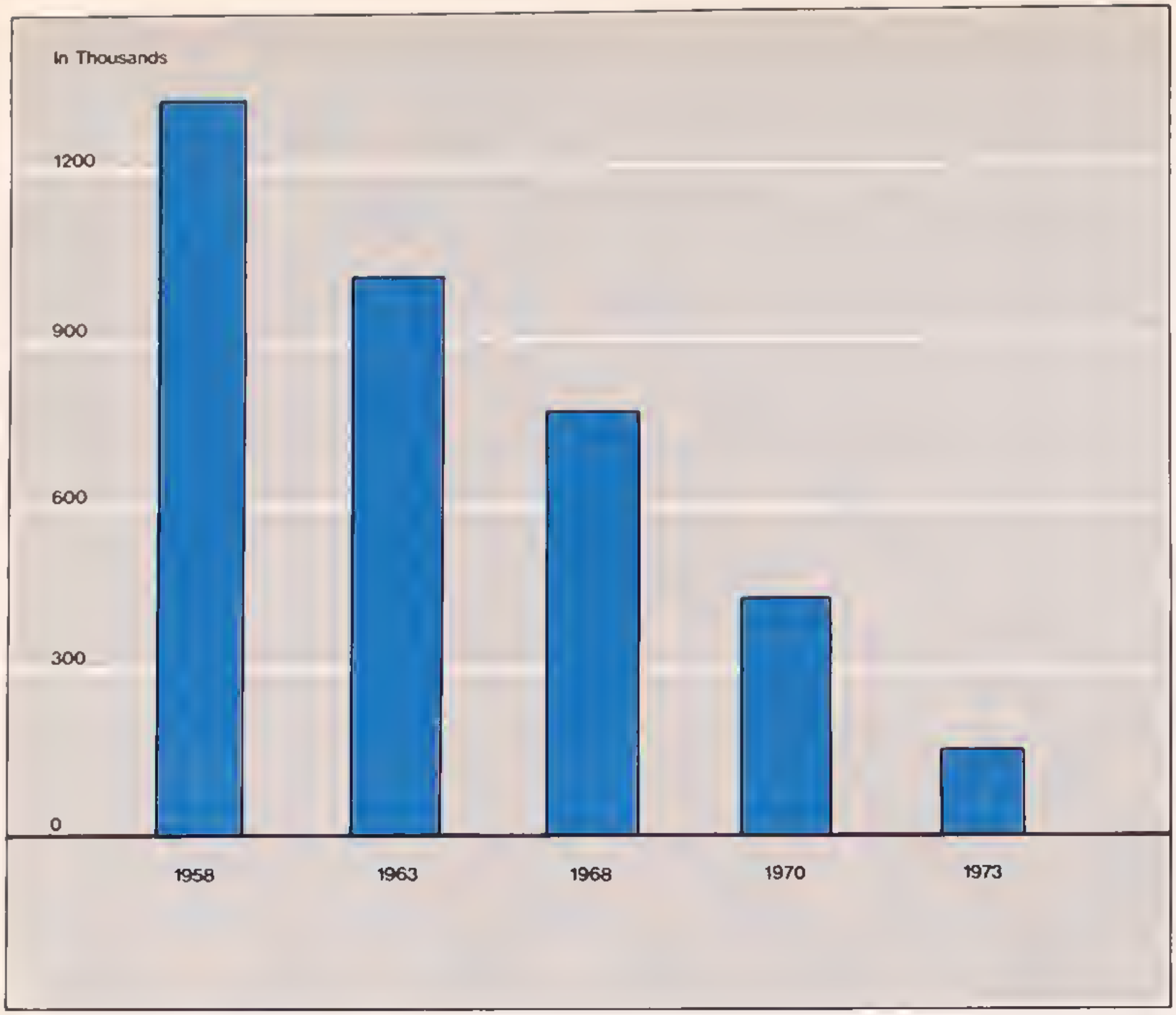


Illustration 10 Changes in Hirings of Longshoremen on West Side Piers 18-99

cargo. Thus, the shippers and customers do most loading and unloading of the relatively small individual items. Each container is moved and stored by the shipping companies as a single unit of cargo. In addition to providing additional security for the cargo, the use of containers greatly simplifies and speeds the ship-loading operation, saving substantial operating and labor costs. As a result, nearly all of the recent and current investment in cargo vessels has gone into building specially-configured and outfitted "containerships". More and more of the world's ocean-borne freight is moving in containers.

The significance of this development for the Port of New York, and for the West Side of Manhattan, is that containerization requires a new and different kind of marine terminal. Extensive space alongside a pier is needed for storing and handling the containers, and for the large trucks which carry them, far more than is required for break-bulk operations. The general "rule of thumb" is that 30 to 50 acres or more of "back-up" space is needed for one container berth. The West Side piers, squeezed tightly together and against the existing West Side Highway, simply do not have adequate space to accommodate these back-up operations. While some ideas for saving space have been advanced, such as vertically stacking containers, they are presently unproven.

None of the West Side piers, with existing configurations and land areas, can handle large numbers of containers. This is especially so in light of the heavy investment in the most modern container facilities just across the River. The Port Authority has invested extensively in New Jersey, where Elizabeth is billed as the finest container-port in the world.

The only significant investment in West Side shipping facilities since World War II has been the extensive remodeling of four finger piers at 23rd Street alongside Chelsea, and the construction of the three-berth box-like Pier 40 at Houston Street alongside the West Village. Both of these occurred more than ten years ago, and these facilities have only very limited container capability. The remodeled Chelsea Piers have not serviced a ship since 1968, and present cargo operations at Pier 40 are small. However, it should be noted that while the Chelsea piers have been classified as inactive since 1968, and prospects of revival for ocean traffic are remote, these piers continue to serve as a source of income for a large number of men. Collective bargaining agreements between the International Longshoremen's Association (ILA) and the New York Shipping Association provide a "Guaranteed Annual Income" (GAI) for all qualified union members in the Port, whether or not work exists for them. The GAI is paid from a special fund endowed by assessments on various shipping lines according to a formula based upon tonnages and man-hours. An eligible Longshoreman can collect his full annual wage in the form of GAI by merely signing in each working day at the appropriate waterfront hiring center. About 450 Longshoremen in the Chelsea area are estimated to be eligible for GAI, reporting each working day to find that there is no work, for there are no ships calling at the Chelsea piers. Thus, these Longshoremen and the Chelsea ILA Local (No. 791) have a continuing interest in these particular piers despite the present absence of cargo operations.

An underlying economic reality is that a cargo-handling facility on a West Side pier generally cannot today be competitive with more modern facilities elsewhere in the Port. Most cargo shipped through the Port has origins and destinations other than the Island of Manhattan. Thus, large amounts of cargo would have to be moved in and out of Manhattan by rail or truck. The only rail freight line to Manhattan connects with the Penn Central main line 140 miles to the north at Albany. Aside from the problems which would be posed for large containers by low clearance highway bridges over that track, shipment west or south via Albany would be far from the most direct and economical route for any cargo.

Movement of cargo in break-bulk or containers in and out of Manhattan by highway is equally unappealing. The already crowded bridges and tunnels leading to and from the island, and the congested arterial street system, would impose time costs which it would be unreasonable to expect shippers to absorb. Again, in contrast with the West Side, the cargo facilities elsewhere in the Port have excellent rail and highway connections. Simply, a cargo operation which might today be found technically feasible for installation on the West Side of Manhattan could operate more efficiently and cheaply somewhere else in the Port of New York. This is the underlying economic reason that cargo shipping on the West Side has all but disappeared. Along the entire West Side waterfront, the only active cargo shipping operation is at Pier 40, but it is very small, and due to be discontinued soon.

The extensive space required for containerized shipping in other parts of the Port (above) contrasts with the limited space and configuration of the vacant Chelsea Piers on the West Side.

Railroading on the West Side

The general cargo which moved to and from the United States by way of Manhattan had to move in and out of Manhattan by either rail or truck. Previously, most long-distance movements in this country went by rail. Consequently, a rail system was developed to serve Manhattan, in large part to service manufacturing and shipping activities on the West Side.

However, an examination of present rail operations and facilities in the area reveals that service has fallen off markedly, and that the railroad companies presently have surplus space on their hands. Much of the valuable Manhattan realty held by the railroads in their yards and rights-of-way on the West Side is in fact lying unused. And large portions are presently occupied by activities which do not utilize the rail facilities, such as warehousing and freight-forwarding. This trend is expected to continue, for many of the economic reasons recited in relation to shipping. Consequently, the railroad situation is increasingly contributing to the area of the West Side which is presently unproductive, close to the center of Manhattan. A brief review will make this clear.

Railroad operation on the Island of Manhattan began shortly before the mid-1800's. Rail access to the Island for those roads that approach New York from the north has been by direct rail link. For those lines that terminate in New Jersey, access has been from the south and west by marine car-float. In the latter situation, marine carfloating was necessary to provide access to the piers of the small land-based rail yards operated by these railroads.

Originally, the railroads built freight facilities in Manhattan to serve as transfer points between the railroads and local delivery and pick-up trucks. Today, however, trailvans—highway trailers that are transported on railcar for a portion of their trip ("piggyback")—are making inroads into the use of boxcars. Of considerable importance is the fact that trailvans are moved to and from the West Side by road.

The 14th Street Railroad Spur is dwindling in operations, but still supplies some service to the Gansevoort Meat Market on the West Side.

There are three major rail operators active on the West Side.

The **Penn Central Transportation Company** operates the only direct rail freight access to Manhattan's West Side. This access, known as the West 30th Street Branch, extends from the Harlem River south along Manhattan's West Side to Bank Street in the vicinity of Greenwich Village. Along its line are three rail yards at 60th Street, 33rd Street and 37th Street.

The 60th Street Yard, extending north into 72nd Street along the Hudson, is the focal point of Penn Central's rail operations in Manhattan, the Bronx and portions of Westchester County. Through freight trains that operate between New York City and northern and western points originate and terminate at this yard. Further, local trains provide service from this yard to lower Manhattan and other points in the New York metropolitan area.

At one time, the Penn Central and its predecessors had extensive marine operations on the West Side of Manhattan. In the late 1960's, a decision was made to reduce drastically this activity. This resulted in the discontinuance of Penn Central pier operations on the West Side and carfloatings to its 37th Street and 60th Street Yards, except for oversized loads to the 60th Street Yard.

The 14th Street spur line, which extended from the 33rd Street Yard south along 10th Avenue and Washington Street to Canal Street on an elevated structure, was built to serve the Gansevoort Meat Market and the St. John's Freight Terminal. Several years ago, rail operations to the St. John's Terminal were abandoned and the line was cut back several blocks to its present terminus at Bank Street.

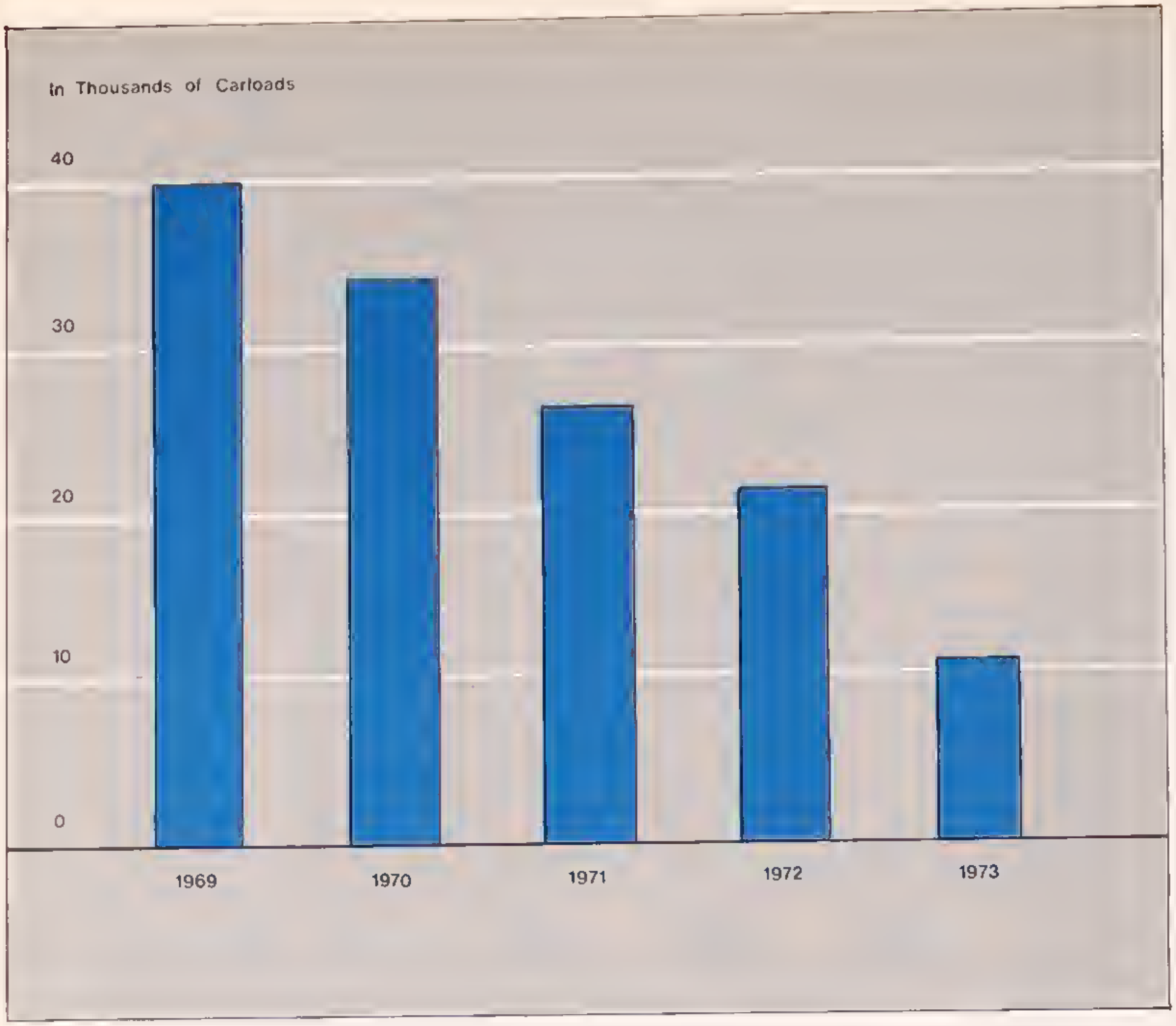


Illustration 11 Changes in Railroad Operations on the West Side

As for future rail activities of the Penn Central, operations in the 33rd and 37th Street Yards show a severe drop in carloadings handled in 1973 from 1972. An important reason for this drop is the effort by the Penn Central to relocate consolidators from its 37th Street facilities to locations in various parts of northern New Jersey. The 37th Street Yard can be expected to show a continued decrease in volume. The activities on the 14th Street Spur are expected to level off at about 400 to 500 cars a year.

There is some indication that the level of freight operations might stabilize. However, forwarder carloadings appear to have been declining, and the decline continues into 1973. At the end of 1973, the bulk of rail activity in the 33rd Street Yard will be dependent upon freight forwarders. Conversations with both the railroad and the freight forwarders reveal that there are forces coming into play that might compel freight forwarders to reconsider the advisability of operating a freight terminal at all in Manhattan.

The railroad recently has been directed by its bankruptcy judge to charge the full cost associated with land and buildings that are offered for lease. The former practice was to lease below cost in order to secure freight traffic. The City of New York has attempted to reclassify as non-railroad any land that a railroad leases to other parties. This has the effect of raising real estate taxes, which are usually passed on to the lessee. The percentage of total freight forwarder traffic originating in the garment area is declining. Finally, traffic congestion levels and waiting time in New York City can make a customer's trip to freight forwarders on the West Side more expensive than the trip to another location.

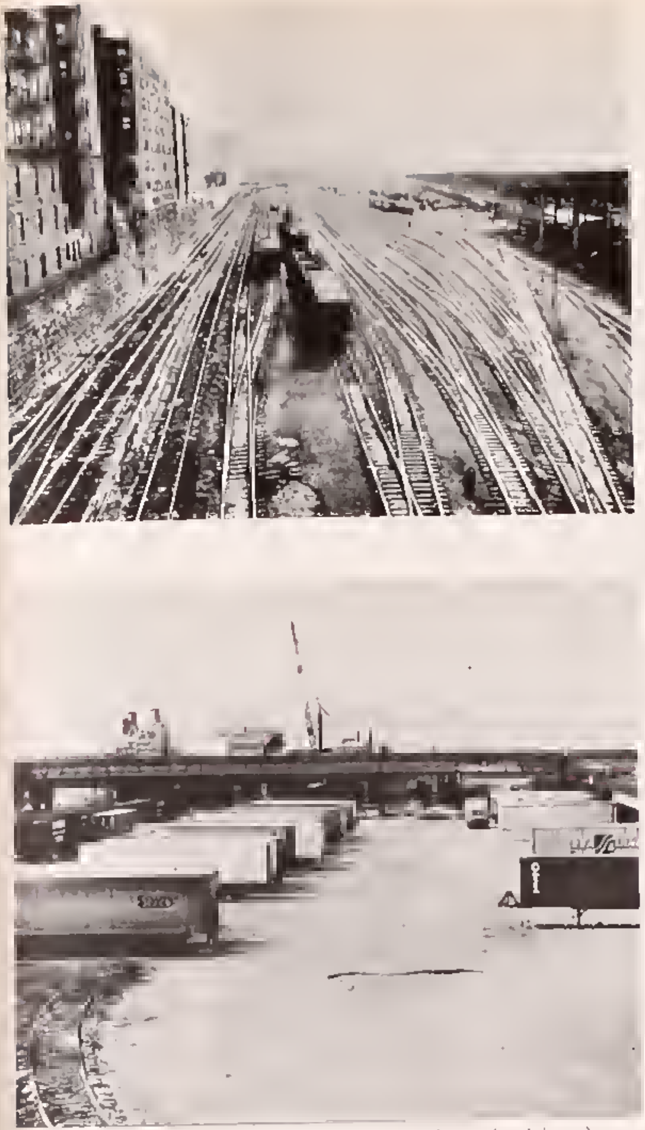
The **Erie-Lackawanna Railway Company** operates the 28th Street Yard, which is served only by marine carfloat. The facilities consist of transfer platforms leased to freight forwarders and consolidators, along with general public tracks and warehouse facilities. It is important to note that the tenants in this yard do not make exclusive use of rail services, and that one tenant uses no rail services at all.

In past years, Erie-Lackawanna and its predecessor had extensive pier operations on the West Side. However, in recent years their operations have been confined to Piers 20, 21 and 48. In the past few months, the railroad terminated all operations at Piers 20 and 21, and is also considering termination at Pier 48. The present tenants at Pier 48 would be relocated to either the 28th Street Yard or New Jersey. But even today, Pier 48 is used only by freight forwarders.

The problems confronting the Erie-Lackawanna and its 28th Street Yard are similar to those at the Penn Central. One of its large consolidator customers is actively considering the relocation of its entire operation outside of Manhattan, where it has constructed a modern freight handling facility. This shift, coupled with the general downward trend of carloadings, can be expected to continue if more traffic is switched from railcar to trailvans. It is quite evident that the future Erie-Lackawanna requirements for rail space and facilities will be diminishing.

The **Chessie System, Inc.** operates the 24th Street Yard, served by marine carfloat. The facilities in the yard consist of transfer platforms under lease to freight forwarders and consolidators, general public tracks and warehousing facilities. The main tenants in this yard make only marginal use of rail car service.

The Chessie System also leases Piers 52 and 66 from the City of New York which it in turn subleases to several freight-consolidating firms. Rail access to these piers is by means of car floats; these are the last operating railroad piers on the West Side waterfront.



The 60th Street Railroad Yards handle few trains today (above), and much of the space in the 30th Street Railroad Yards is used for trucking operations and storage (below).

On the basis of present knowledge, there is a slight downward trend in local Chessie operations, particularly at the 24th Street Yard, and Piers 52 and 66. The shift to trailvans at the 24th Street Yard is practically complete and the operations at Piers 52 and 66 are expected to remain completely car-float supported. The future level of activity at these facilities will be almost entirely dependent on the level of economic activity within that area of Manhattan.

Thus, rail activity on the West Side is presently on a decline which is anticipated to continue. Total railroad activity is expected to remain at a level which will justify some continued rail access to the West Side for this decade. However, there appears to be a substantial opportunity for consolidating present rail operations, as well as non-rail activities currently located on railroad property.

Trucking on the West Side

The West Side of Manhattan contains one of the most intense concentrations of truck activity and commodity movement in New York City. Most of the truck activities originally oriented to the maritime industry were located on the West Side because of proximity to port facilities, and because they could offer good service to their clients in Manhattan. In the early 1960's, the pier freight activity on the West Side waterfront began the decline already described. With the cargo shipping shifting to Newark and Elizabeth in New Jersey, and to Brooklyn and Staten Island in New York, the operations of many of the truckers on the West Side also shifted to those areas.

The precipitous decline in maritime and related uses on the West Side waterfront resulted in vacancies and deterioration along the River and adjacent land areas. The owners of these underused facilities sought new sources of revenues, while businessmen with operations highly sensitive to space costs looked to these newly available and inexpensive locations.

As a result, new freight consolidation and warehousing moved to the West Side at a rapid date during the past decade, which in turn generated a wide range of trucking operations and facilities in the area. In the process, truck rental facilities, repair shops and parts suppliers were attracted. Although some of the space was taken for convenience of access to customers in Manhattan, these locational advantages were probably far outweighted for the majority by the fact that the space was relatively cheap.

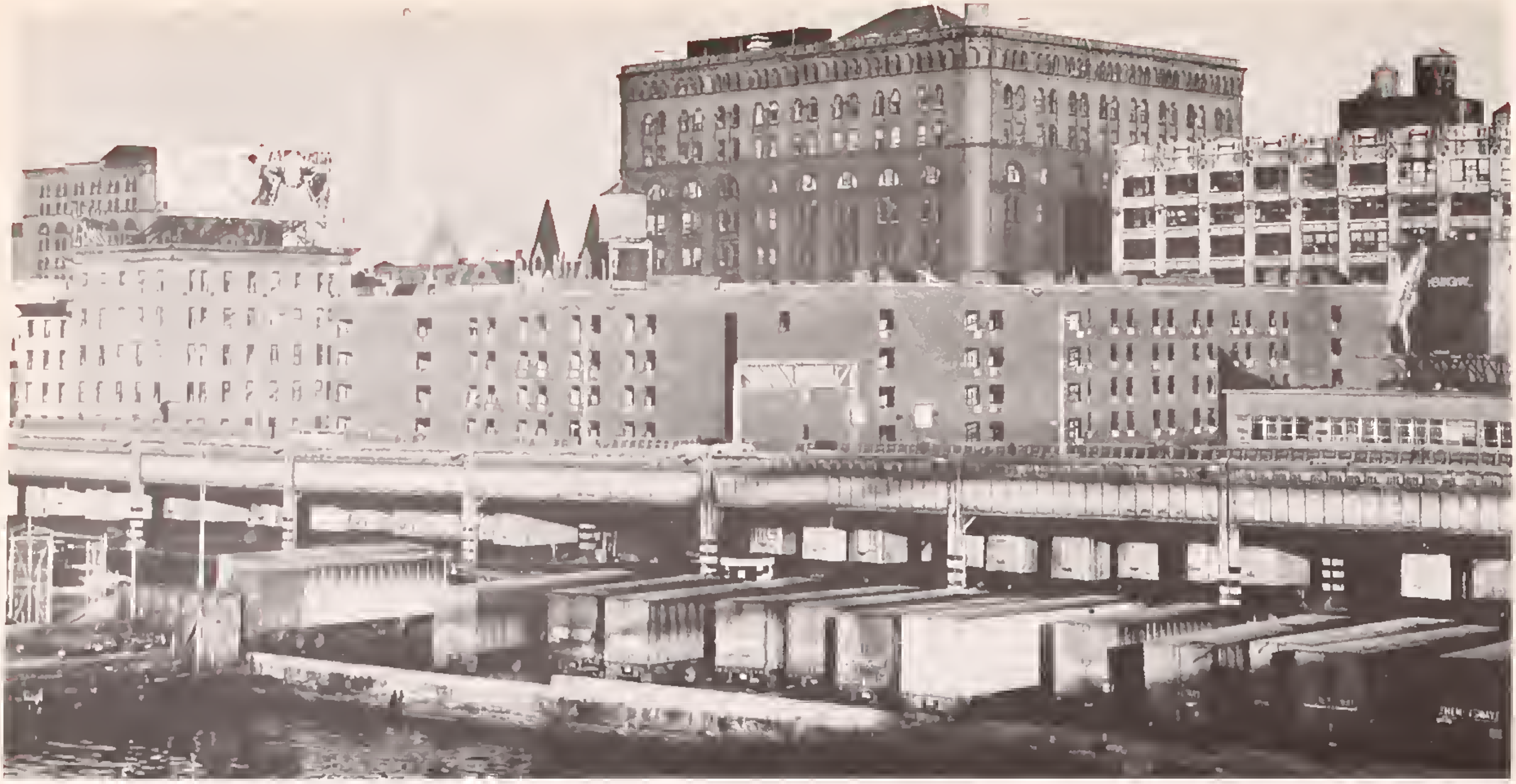
However, the West Side street networks and facility access were not designed to handle large numbers of tractor-trailor trucks. This substantial inadequacy soon produced considerable local congestion, which in turn imposed large-scale inefficiencies upon trucking operations. Thus, there has been a more recent counter-movement by those firms sensitive to congestion costs, generally operations not tied to Manhattan customers or suppliers. Such firms have been moving to Brooklyn, Staten Island and to New Jersey, abandoning some portions of the West Side infrastructure, while the numbers of trucks moving on Manhattan streets remain substantial.

The trucking concerns that have shifted their operations elsewhere have been influenced by one or more of the following reasons: (1) proximity to Newark and Elizabeth; (2) more favorable labor situations; (3) newer and better facilities, including ample loading, maneuvering and parking space; (4) relocation of clients out of Manhattan; (5) lower taxes; and (6) more favorable local governmental policy.

Those truckers which have remained on the West Side are able to offer good service to their clients because of proximity to client facilities and convenient access to the Hudson River tunnels. Many have continued West Side operations because they feel that the location benefits them in making multi-stop pickup and delivery trips in Manhattan, or because they serve a very specialized market. However, some of the remaining trucking firms with addresses on the West Side maintain only a sales or dispatching office with little trucking activity oriented to the area. The decline of general trucking activities along the West Side is expected to continue. However, the futures of those trucking operations which service the Gansevoort Meat Market at West 14th Street, and the Garment District in the West 30's, are tied more to the future activities of those specialized areas than to the general economics of trucking on the West Side.

Truck Terminals and Warehouses Two major truck terminals—St. John's and the New York Union Motor Freight Terminal—are located within the Project study area. The St. John's Terminal was originally constructed for consolidators. Railroad freight cars were brought directly inside the building where they were loaded with outbound cargo. With the decline of the shipping industry on the waterfront, the consolidators have moved out, the tracks have been removed, and the 14th Street rail spur now terminates to the north at Bank Street. The building currently is being converted partially to offices. Thus, the facility is no longer used primarily for trucking or as a warehouse facility. It appears that the St. John's Terminal probably will be devoted to office use in the long run.

The New York Union Motor Freight Terminal, completed after the second World War, was built as a consolidated trucking terminal. However, due to a number of union problems and the truckers' concern over discontinuity of responsibility over a consignment during consolidation, the terminal facility was never fully utilized. Office space accounts for about one-third of the building, and until recently the building was only about 75 percent occupied. However, United Parcel Service (UPS) has recently signed a 25-year lease for a substantial part of the operating space in the terminal. The facility, with some modifications, will be used by UPS as an adjunct to the West Side 43rd Street terminal for local consolidation and delivery operations.



Large numbers of truck trailers are parked beneath and adjacent to the existing West Side Highway along the waterfront.

Many of the warehousing structures in Lower Manhattan were built in the early part of the century and are multi-level. Most public warehousing was located on the West Side initially because of its proximity to the piers. Since importing activity has moved to other locations, warehousing on the West Side has become less viable and the number of facilities has decreased. With the decline of manufacturing and shipping in Manhattan, the high labor rates and difficulty with union demands, only those commodities which are captive or important for distribution to the local area are generally brought into these warehouses. The newer warehousing facilities are tending toward locations in New Jersey and Staten Island and are generally single-level, with storage space and loading facilities designed to handle containers.

Truck Parking While general office and warehousing facilities for trucking operations on the West Side waterfront are considered adequate, there is a severe shortage of parking and loading space for trucks operating in the area. As a result, truckers have turned to the public space stretching up and down the waterfront beneath the elevated structure of the existing West Side Highway.

Trucks contribute substantially to street congestion on the West Side.

This space, including portions of West Street/12th Avenue, is owned by the City of New York. However, given the generally deserted nature of the area, the space is not in great demand for other uses. As a consequence, the City permits most of the area beneath the existing West Side Highway to be used by the trucking companies for the storage of their tractors and trailers. The companies receive annual permits from the City for a nominal fee, entitling them to use a defined piece of property. In practice, however, companies park their trucks only generally in their assigned areas, tending to take almost any empty space under or near the Highway. One result is that portions of the area along West Street/12th Avenue function much like a long parking lot for trucks.

Although technically a temporary arrangement, with the permits revocable at the City's pleasure, annual renewals have become routine, and the space has come to be taken for granted by the truckers. In fact, Project surveys indicate that most of them now consider this almost no-cost space under and around the Highway as essential to their operations in Manhattan. Without the use of this public space, the already marginal trucking operations on the West Side waterfront would be even more marginal.

Summary The West Side of Manhattan historically has housed diverse and voluminous freight-handling activities, including the movement of goods by water, rail and truck. The decline of such movements during recent decades, and the present relatively low level of freight activities, can be understood completely only within the context of the manufacturing and maritime background of the West Side of New York City.

For over a century, the West Side functioned as this nation's principal port. Accordingly, Manhattan south of 59th Street was equipped fully with the infrastructure requisite for servicing this maritime activity, including extensive railroad and trucking interfaces. However, changes in the manufacturing and shipping sectors during recent years have drastically reduced cargo shipping and related freight handling and movements on the West Side. Contemporary technology and space requirements cannot be accommodated within the facilities now available on the West Side. The existing piers can handle only the continuously diminishing break-bulk cargo activities.

In addition, direct rail and road access to Manhattan is very limited. These factors, in conjunction with Manhattan's declining industrial base, have rendered the West Side both a continuously diminishing point of ultimate origin and destination, and an inadequate trans-shipment point. Most goods handling activities on the West Side have thus become marginal in both operational and economic terms. Any large-scale reversal of these trends is highly unlikely.

A legacy of this course of events is a substantial but vestigial and decaying complex of cargo facilities on the West Side.

The interior of a vacant pier on the West Side waterfront.

Present State of the West Side Piers
It is appropriate at this point to look briefly at the present physical state of the piers which comprise the West Side waterfront, and the uses to which they currently are being put.

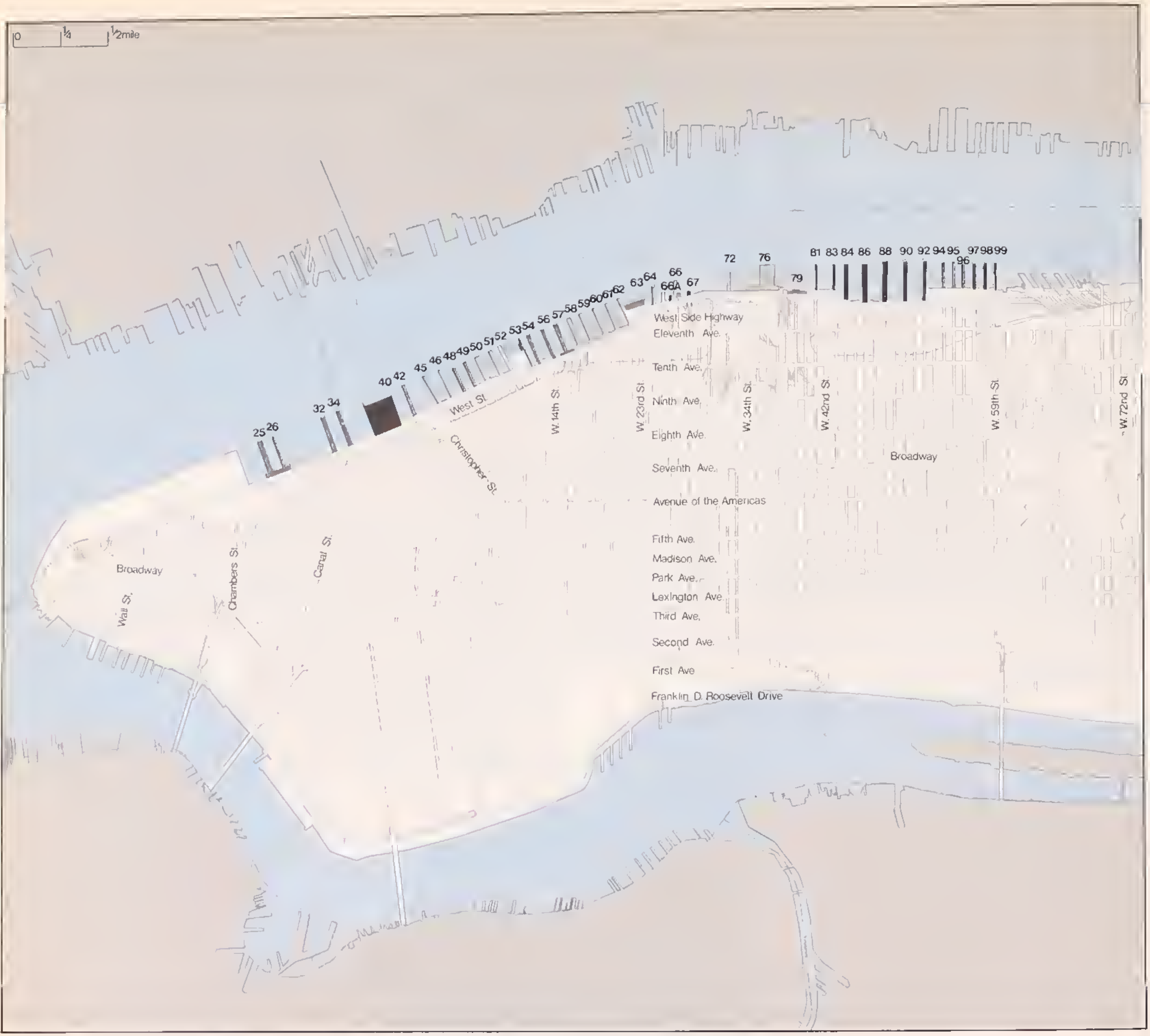
Between the Battery and 59th Street on Manhattan's West Side, there are only 42 piers still standing. Only 30 of the 42 standing piers are being used at all. And of the 30 still in use, only four are active for shipping, the others housing a variety of uses unrelated to the River. Three of the active shipping piers handle only passenger ships, and are located to the north of the Project's study area. Only one pier on the entire West Side remains active for cargo shipping.

The size of the piers varies, but on the average, a pier is 150 feet wide and 800 feet long, exclusive of the headhouses along the shoreline. The spacing between the piers ranges from 200 to 300 feet. In general, the depth of the water between piers at low tide varies from 15 feet to 35 feet. Severe problems of silt have reduced the depth of water under older piers to between 0 to 3 feet, while the water under the newer piers is between 25 and 30 feet deep. With few exceptions, most of the piers are supported on untreated timber piles.

The following profile of Manhattan's Hudson riverfront proceeds from south to north. The locations of the piers discussed in the text are shown in Illustration 12.

From the Battery to Canal Street In Lower Manhattan, there are no piers in maritime use. Piers 13-21, from Battery Park to north of the World Trade Center, are being demolished and replaced with landfill for construction of the 100-acre Battery Park City, a residential and commercial development by a special-purpose state agency, the Battery Park City Authority.

Piers 25-34, north of Battery Park City to Canal Street, are either vacant or used for parking, salvage, or municipal automobile storage. Piers 27 through 29 were abandoned during the 1960's, and were destroyed by fire in January of 1973.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West Side Highway
Eleventh Ave.
Tenth Ave.
Ninth Ave.
Eighth Ave.
Seventh Ave.
Avenue of the Americas
Fifth Ave.
Madison Ave.
Park Ave.
Lexington Ave.
Third Ave.
Second Ave.
First Ave
Franklin D. Roosevelt Drive
West St.
Christopher St.
W. 14th St.
W. 23rd St.
W. 34th St.
W. 42nd St.
W. 59th St.
W. 72nd St.
Broadway
Broadway
Wall St.
Chambers St.
Canal St.

Between Canal and 14th Streets Pier 40, the only West Side Pier still used for cargo shipping, is located just north of Canal Street. It was rebuilt by the City of New York in 1963 at a cost of $25 million, designed for break-bulk cargo and passenger operations. Occupying approximately 18 acres, it is a box-like structure with three berths and a two-story headhouse around its periphery. The City owns the facility, and leases it to the Port Authority. Today, it is used almost exclusively for passenger cruises by Holland-America Cruises and the Norwegian-American Line. Venezuelan Lines and Prudential-Grace Lines still maintain cargo facilities there, but only about one cargo ship per week arrives. Inbound cargo of coffee and cocoa is destined for the metropolitan area outside of Manhattan, and only 10 percent of the general outbound cargo originates in Manhattan. Officials of Prudential-Grace and Venezuelan Lines have indicated their intention to relocate elsewhere in the Port sometime in the next two years. This move, when it occurs, will completely remove cargo operations from the West Side waterfront. However, Pier 40 will continue to serve passenger shipping, since its three berths will be a part of the new Consolidated Passenger Ship Terminal, for which six new berths are being built in Midtown.

Just north of Pier 40, at the southwestern edge of Greenwich Village, is the Morton Street Pier (Pier 42). A few years ago, the City tore down the superstructure and opened the remaining rough deck for recreation, in response to community pressures. In addition, the New York City Board of Education moors the **S.S. John Brown** and the **S.S. Twin Falls Victory**, both maritime-training vessels, at Pier 42.

Piers 45 to 52, between Christopher and Horatio Streets, presently house a mixture of activities. A theater arts center has been proposed for the vacant Pier 45, but no action has been taken or funds committed. The Pier 46 headhouse is being used for freight handling, and Pier 48 is vacant. The Bank Street

Illustration 12 Present Status of Piers on the West Side

▭	Vacant Existing Piers
▨	Non-shipping Use
■	Shipping Activity
↗	North

Current Use and Plans for Piers From the Battery to Canal Street

West Side Piers	Current Use	Announced or Planned Use
Pier 25	Auto Storage	No Change
Pier 26	Parking	No Change
Pier 32	Salvage Depot	No Change
Pier 34	Auto Storage	No Change

Current Use and Plans for Piers from Canal Street to 14th Street

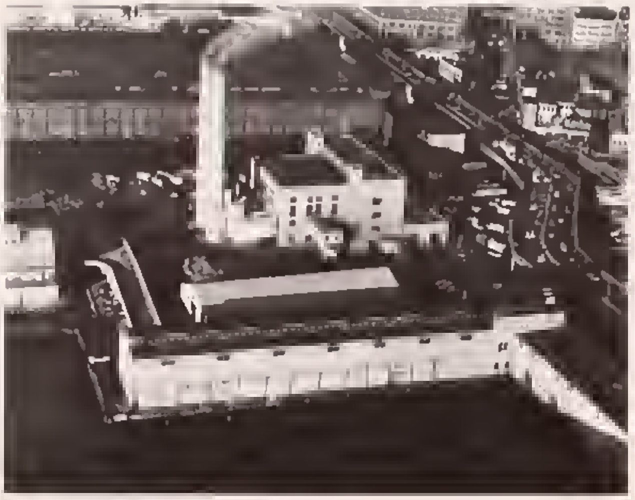
West Side Piers	Current Use	Announced or Planned
Pier 40	Cargo and Passenger Shipping	Possible Cessation of Cargo Operations
Pier 42	Recreation and Education	No Change
Pier 45	Vacant	Theater Arts
Pier 46	Freight Consolidation in Headhouse	No Change
Pier 48	Vacant	No Change
Pier 49	Vacant	Unknown
Piers 46-49 (bulkhead)	Lighterage and Freight Forwarding	No Change
Piers 50, 51	Damaged by Fire	Unknown
Pier 52	Lighterage and Freight Forwarding	No Change
Between 52, 53	Incinerator and Marine Transfer Station	No Change
Pier 53	Truck Parking	No Change
Pier 54, 56	Auto Storage	No Change

West Village residents enjoy the Morton Street Pier, where the Maritime High School ship is permanently docked.

Pier (Pier 49) is currently used by area residents for recreation, although it has never been so designated by the City and no improvements have been made to the deteriorating structure.

Piers 50 and 51, previously vacant and deteriorating, were damaged by a large fire in June 1973; subsequently, their sheds have been demolished, leaving only the pier decks. A small section at the end of Pier 52, at Gansevoort Street, has been used by local residents for recreation from time to time. However, it is now so deteriorated that it can no longer be used safely.

Ben Kocivar



The Gansevoort Destructor incinerates City refuse on the waterfront near 14th Street.

Between Piers 52 and 53, between Horatio and West 12th Streets, is the City's solid waste disposal complex known at the Gansevoort Destructor, consisting of an incinerator and a marine transfer station. The seven-acre site also accommodates a City Highway Department salt shed. Between 80 and 100 men are employed at the complex, where an average of 350 trucks enter and leave daily. About 150 of these trucks unload into the incinerator for burning, while about 200 deposit their unburned refuse directly into barges at the marine transfer station.

The incinerator was constructed in 1953 and is the oldest of seven such facilities in New York City. Although it has a design capacity of 1000 tons per day, actual working capacity is between 700 and 900 tons per day, depending on maintenance schedules and periodic repair work involving the four ovens.

Truck trailers are stored on a partially demolished West Side pier

Incinerated residue is deposited into trucks and hauled to the adjacent marine transfer station for barge transport to landfill sites on Staten Island. Daily residue averages 400 tons, requiring approximately 400 truck trips per day to the marine transfer station. A fleet of nine trucks is maintained for this purpose. The incinerator utilizes a relatively obsolete technology. It generates substantial air pollution and is occasionally the center of local controversy. According to Sanitation Department officials, it would cost between $6 and $10 million to upgrade the plant to meet current air pollution standards.

The marine transfer station consists of two barge slips, an enclosed overhead dumping shed constructed on piles, and concrete access ramps constructed on landfill. The station handles an average daily volume of 2000 tons which, unlike the volume of the incinerator, can be expanded according to need by adjusting barge schedules or initiating round the clock operations. Although the station is structurally sound, it is too small to handle many of the new, larger garbage trucks and construction waste carriers. This inadequacy is a result of the small internal turning radius in the dumping shed and steep grades on the entrance ramp. Therefore, many private refuse carriers are now diverted from the facility and must drive their vehicles to dumping sites outside Manhattan.

At the Marine Transfer Station, next to the Gansevoort Destructor, garbage is loaded onto barges.

The remaining piers below 14th Street also are used for non-maritime activities. Pier 53 is vacant except for some storage of materials by the Department of Sanitation. Piers 54 and 56 are used by the New York City Police Department for storage of automobiles.

North of 14th Street At 14th Street, Pier 57 is used by The Metropolitan Transportation Authority to store and repair its buses, under a permit strongly opposed by local area Longshoremen last summer. Piers 59-62, stretching from 17th to 23rd Streets, have been under long-term lease to United States Lines from the City of New York. These are the so-called "Chelsea Piers," described previously, which were completely renovated by the City between 1963 and 1968 to accommodate general break-bulk cargo. However, since completion of the renovation in 1968, no ship has ever called at any one of these piers. Since they cannot accommodate containers, the prospects for any future shipping here are remote. Subsequent to signing the lease for these Manhattan facilities, United States Lines moved all of its operations to New Jersey. In Fall of 1973, the City and U.S. Lines announced a proposed agreement, whereby the lease on the Chelsea Piers would be cancelled in return for moving the shipping company's operations from New Jersey to new facilities on Staten Island.

The short and squat Pier 63 at 23rd Street is under lease to Neptune World Wide Moving, Inc., until 1991, and is used only for freight storage without any water movements. Pier 64 is used as another warehouse for City vehicles.

Pier 52, at Horatio Street and Pier 66, at 26th Street, are leased by the City to the Chessie System for railroad carfloat operations, which are steadily decreasing, as described previously.

Between 26th and 41st Streets, the existing piers are put to myriad uses. At 30th Street, the Port Authority operates a private heliport on the site of Pier 70, which has been demolished. The bulkhead area of Pier 72 is used by Colonial Sand and Stone Company, one of New York City's principal suppliers of concrete. Raw ingredients are transported to this site on the river by barge and scow primarily from Kingston and Port Washington. Given the maximum one-half hour between loading and on-site mixing required by City regulations, this plant is primarily a supplier of West Side construction sites. Colonial's West Side operation, which is one of its 15 plants in New York and New Jersey, and one of its two Manhattan plants, employs about 24 people.

Pier 76, at 37th Street, is vacant and leased by U.S. Lines along with the Chelsea Piers, which lease is due to be terminated. The shoreside area which presently constitutes Pier 79 is under lease for warehousing Pier 79 formerly was used for Penn Central Railroad carfloating. In previous years, such operations were conducted extensively on the West Side because the pier area between 30th and 40th Streets lies directly west of the Penn Central's 33rd Street and 37th Street Yards. Today, however, numerous tracks have been removed from these yards, as described earlier.

Current Use and Plans for Piers North of 14th Street

West Side Piers	Current Use	Announced or Planned Use
Pier 57	Bus Storage	No Change
Pier 58	City Storage	No Change
Piers 59-62	Vacant	No Change
Pier 63	Freight Forwarding	No Change
Pier 64	Auto Storage	No Change
Pier 66	Being Demolished	No Change
Pier 70 (Bulkhead)	Heliport	No Change
Pier 72	Vacant	No Change
Pier 76	Vacant	No Change
Pier 79	Warehousing	No Change
Piers 81 & 83	Sightseeing Tours	No Change
Piers 84 & 86	Passenger Shipping (Interim)	Convention Center
Piers 88-92	Reconstruction	Passenger Liner Terminal
Pier 94	Parking	No Change
Piers 95-96	Auto Storage	No Change
Pier 97	Passenger Shipping (Interim)	Unknown
Pier 98	Fuel Barging	No Change
Pier 99	Marine Transfer Station (Inactive)	No Change

Many railroad carfloat piers on the West Side have been abandoned

At 41st and 43rd Streets, Piers 81 and 83 are occupied by Circle Line-Sightseeing Yachts, Inc., which operates sightseeing and excursion vessels providing tours around Manhattan Island and up the Hudson River to Bear Mountain, West Point, and Poughkeepsie. The line serves approximately one million passengers annually, excluding chartered cruises. Though there was some decline in passengers in 1971, attendance picked up in the summer of 1972, and the company anticipates continued, active operations. These are the northernmost piers actually within the study area of the West Side Highway Project.

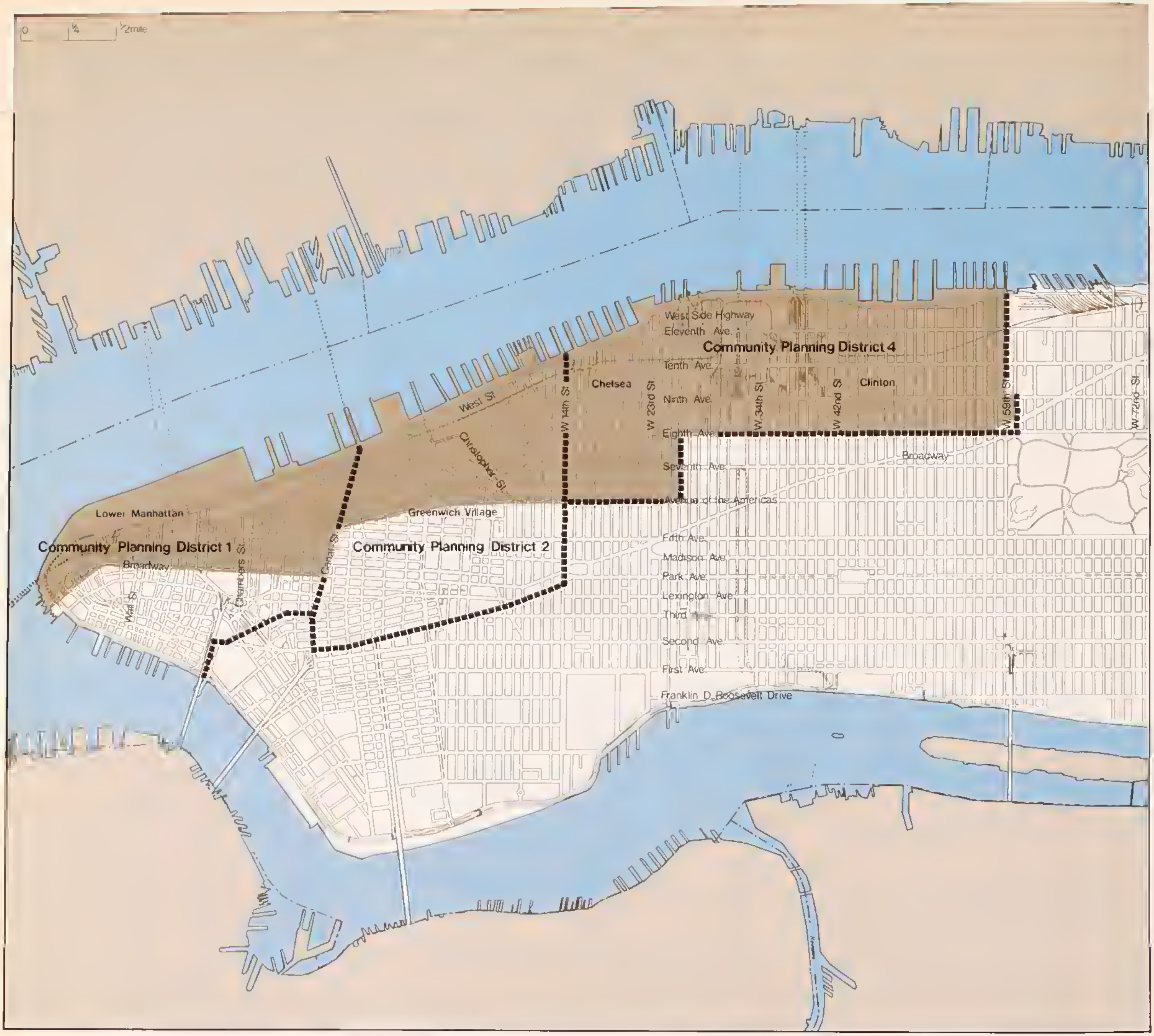
North of the Project's study area, Piers 84 and 86 in the 40's and Pier 97 at 57th Street are currently being used on an interim basis for passenger liners, pending completion of reconstruction of Piers 88, 90 and 92 as the Port Authority's new Consolidated Passenger Liner Terminal. This new construction will include a six-berth passenger ship facility. Along with the existing three-berth facility at Pier 40, downstream some two and one-half miles, these piers together will constitute the nine-berth Consolidated Passenger Liner Terminal. They will be the only points of oceangoing passenger embarkation and debarkation in the Port. Completion is scheduled for mid-1974.

After transfer of passenger operations to the new Terminal, Piers 84 and 86 may be demolished, as they occupy the site of the proposed New York City Convention and Exhibition Center, a major facility with over 500,000 square feet of exhibit space, recently approved by the Board of Estimate.

This brief survey shows that cargo shipping on the West Side waterfront and railroading and trucking in that area are in serious decline. Generally, what is left along the Manhattan side of the Hudson is a collection of largely unused structures built to service the commerce of another era. A handful of the pier areas are in various uses for the moment simply because they offer cheap space. However, there are some notable exceptions to this general waterfront pattern in the West Side Highway Project study corridor, but they are new residential and commercial developments which are unrelated to maritime commerce.

Shannon/Associates

Passengers ships dock at temporary facilities in Midtown (above), while the new Consolidated Passenger Ship Terminal is under construction (lower left), and Circle Line sightseeing boats operate from the pier at 42nd Street (lower right).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Community Planning District 1
Community Planning District 2
Community Planning District 4
Lower Manhattan
Greenwich Village
Chelsea
Clinton
West Side Highway
Eleventh Ave.
Tenth Ave.
Ninth Ave.
Eighth Ave.
Seventh Ave.
Avenue of the Americas
Fifth Ave.
Madison Ave.
Park Ave.
Lexington Ave.
Third Ave.
Second Ave.
First Ave.
Franklin D. Roosevelt Drive
Broadway
Broadway
West St
Christopher St
Canal St
Chambers St
Wall St
W 14th St
W 23rd St
W 34th St
W 42nd St
W 59th St
W 72nd St

Illustration 13 The West Side Highway Project Study Corridor

▨ Project Study Corridor

▭ Limits of Community Planning Districts

↗ North

The Study Corridor

The West Side Highway Project initially was charged by the Governor and Mayor, and required by Federal law and regulation, to develop and evaluate a range of transportation alternatives of varying nature and scale within the context of existing and projected economic, social and land-use conditions. In order to acquire and analyze the information for this effort, it was necessary to define geographically the extent of the West Side areas which the Project would examine.

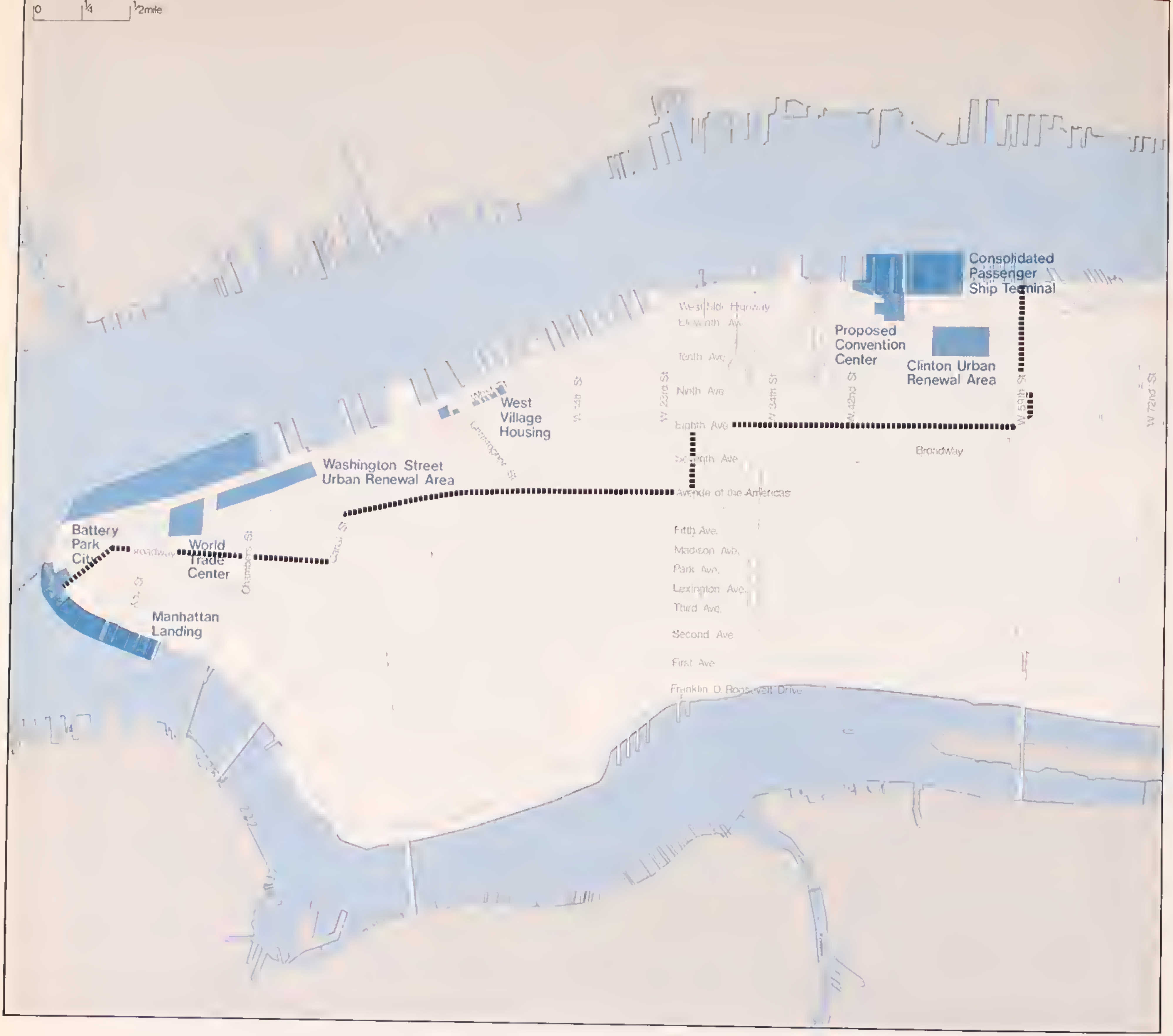
Obviously, these areas could not be limited to just the physical corridor which had been designated for location of the transportation alternatives, for that only extended from roughly the River ends of the piers to the east side of West Street. Neither could Project investigations be limited to the areas immediately adjacent to West Street and the transportation corridor, for this would have excluded neighborhoods and employment centers surely to be affected potentially by the Project options. Since Manhattan is not an urban monolith, but is comprised of so many diverse residential and commercial communities so close together, it seemed necessary for this kind of planning effort to investigate an area broad enough to be commensurate with the character of the Island. Therefore, early in the Project, a general "Study Corridor" was delineated which would encompass approximately the western one-third of Manhattan below 59th Street. While any boundary by nature would be somewhat arbitrary, this Study Corridor includes substantial portions of all four West Side communities —from Clinton on the north through Chelsea and Greenwich Village to Lower Manhattan on the south, and of the three Community Planning Districts covering that area, whose officers sit on the Project Steering Committee. Because the techniques of analysis and organization of data differed for each of the major areas of investigation, the precise eastern boundaries of the area had to be drawn slightly differently for socioeconomic studies, for environmental studies, and for transportation planning. However, all Project work has been based upon substantially the same Study Corridor.

The Study Corridor for socioeconomic studies is shown in Illustration 13. This five square miles is about 20 percent of Manhattan's area, and contains about eight percent of its people. As profiled in the preceding section, the Hudson River waterfront itself constitutes a major component of this Corridor, with its strategic location and present state of decay and underutilization. Historically, the waterfront dominated the fabric of the West Side, as primary generator of jobs and life styles for the area. But, as described earlier, the cargo shipping industry has already declined severely in Manhattan, leaving many facilities vacant along the West Side waterfront. For this and other reasons, railroad operations on the West Side have been plummeting in recent years in an accelerating trend, leaving the yards and tracks largely idle. As shown, there is still substantial trucking activity on the West Side, but mostly it is not in the nature of supporting through movements as in the past. Rather, the area is full of freight forwarders and consolidators in search of inexpensive warehouse, terminal and parking facilities. While this area provides them with the last major source of such cheap space in Manhattan, their pickup and delivery operations generate a great amount of medium-size truck traffic, which is forced to filter through congested commercial areas and residential neighborhoods. Gradually, the costs of operation in Manhattan are causing the truckers to move out, to facilities in other parts of the metropolitan area.

The existing West Side Highway runs the length of the corridor, effectively cutting off the communities to the east from the waterfront. The elevated steel structure acts as a visual and psychological barrier, with its forest of supporting ramps and columns, and sometimes continuous wall of trucks and trailers parked or maneuvering beneath.

The existing West Side Highway is a continuous barrier between West Side communities and the Hudson River.

Empty piers and parked truck trailers, along with the Highway, seal off sections of the waterfront from public access.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Consolidated Passenger Ship Terminal
Proposed Convention Center
Clinton Urban Renewal Area
West Village Housing
Washington Street Urban Renewal Area
Battery Park City
World Trade Center
Manhattan Landing
West Side Highway
Eleventh Ave
Tenth Ave
Ninth Ave
Eighth Ave
Seventh Ave
Avenue of the Americas
Fifth Ave
Madison Ave
Park Ave
Lexington Ave
Third Ave
Second Ave
First Ave
Franklin D. Roosevelt Drive
Broadway
W. 14th St
W. 23rd St
W. 34th St
W. 42nd St
W. 59th St
W. 72nd St
Canal St
Chambers St
Wall St

Illustration 14 New Development on the West Side

🟦 Developments Currently Under Construction or Planned

┅ Limits of Project Study Corridor

↗ North

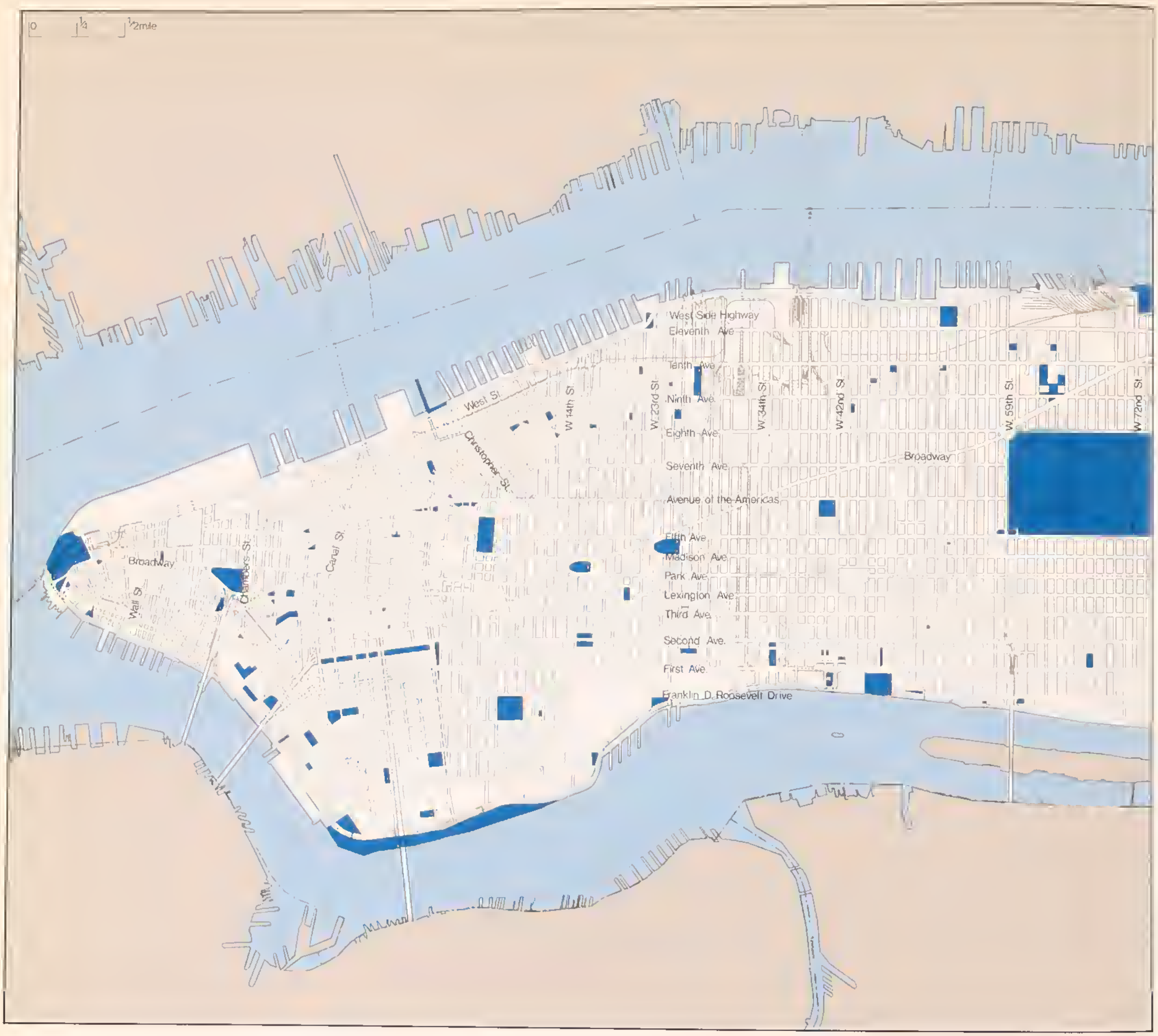
That there are social desires and economic demands for residential and recreational access to and usage of the waterfront is evidenced by some recent developments. At two places within the Corridor, housing is currently under construction adjacent to West Street, and at one place people are already living in some handsomely converted commercial space. The latter is at Westbeth, in the block along West Street between Bethune and Bank Streets, in the western part of Greenwich Village. Here a private foundation has sponsored conversion of the former Bell Telephone Laboratories building into about four hundred apartments, for artists and their families at subsidized rentals.

Just to the south, stretching along Washington Street for seven blocks, between Bank and Morton Streets, construction is nearing completion at the West Village Housing development. This project was long advocated by the West Village community, and finally located along the vacated railroad right-of-way of the Penn Central 14th Street spur line, and some additional adjacent parcels. It will provide 420 units in five-story walk-up buildings for sale as cooperatives, again close to West Street. This project is considered by many in the community to be a prototype for new residential construction in the area. Such low-rise construction allows Greenwich Village to expand westward while maintaining its present character.

About two and one-half miles to the south, a large Mitchell-Lama subsidized middle-income apartment complex is now being built. This Washington Street Urban Renewal Area, on the site of New York City's former wholesale produce center, the Washington Street Market, is located a short distance north of the World Trade Center. The first stage of 1330 apartments is nearly finished, and the second stage of 2000 units about to begin. A new Manhattan Community College is planned as a part of the project. These recent developments indicate that people are desirous of living closer to the River, and that financial and governmental institutions are beginning to recognize this.

In addition, people are trying to break through to the waterfront for recreation, seeking a place to sit, walk, bicycle, fish or just look at the River. Although determined individuals are sometimes seen picking their way through debris along rotting piers in search for a place in the sun, there are really only two locations where people now can have access to the waterfront under reasonable conditions. Near Christopher Street, west of the Village, Pier 42 has been stripped of its superstructure and the remaining deck opened to area residents for recreation, again after substantial community pressure. Although no more than a hard surface jutting into the Hudson, this "Morton Street Pier" is heavily patronized, even crowded on nice days and weekends. Along the near-end of the pier, a narrow strip of land has been paved and furnished with benches and planters by the City Parks Administration. Really an adjunct to the Morton Street Pier, and wedged between the bulkhead and the existing West Side Highway, this area too is heavily patronized.

New housing on the West Side is going up at the Washington Street Urban Renewal Area (above), and the West Village Housing Development (left).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W. 23rd St.
W. 34th St.
W. 42nd St.
W. 59th St.
W. 72nd St.
Broadway
Chambers St.
Canal St.
Wall St.

Illustration 15 Existing Park and Recreation Areas in Manhattan Below 72nd Street

🟦 Existing Park and Recreation Areas

North

It should be noted here that the Study Corridor generally is woefully deficient in recreational and open space in Clinton, Chelsea and Greenwich Village. In 1970, there were only about 53 acres of parks and playgrounds in the Corridor, serving a population of 121,000. (See Table 9.) This represents an average of 0.43 acres per thousand persons. This is well below the existing Manhattan average of 1.42 acres per thousand, as well as below the Regional Plan Association goal of 0.6 acres per thousand for each community in Manhattan. Except for a few major open spaces such as Battery Park, DeWitt Clinton Park and Washington Square, most recreational facilities are less than one acre in size. Furthermore, almost half the Corridor acreage is in Battery Park at the tip of Manhattan, well removed from existing residential concentrations in the Corridor. The details of existing open space conditions in the Corridor are contained in a special Project report.[12]

The other major thrust toward the River is a development of much greater scope, adjacent to the southernmost portion of Manhattan. Here, the Island literally is being expanded into the Hudson, with the 100-acre land fill Battery Park City. The special-purpose Battery Park City Authority, under long-term lease with the City, plans to oversee the development of nearly 15,000 apartments (30 percent luxury, 56 percent middle-income, and 14 percent lower-income), six million square feet of offices and a one million square foot retailing center over the next 20 years. The final section of the fill is underway, and the first complex of 5,600 apartments is about to enter early stages of construction. Battery Park City will also include substantial open space accessible to the public, including a promenade along the River for its entire length. This will add to the park area already available in Lower Manhattan, the one community in the Corridor which currently has open space considerably in excess of regional standards.

Just across the existing West Side Highway from the northern portion of Battery Park City is the World Trade Center complex. Also adjacent to West Street, this project of the Port Authority of New York and New Jersey is partially occupied and now nearing completion. The twin 110-story towers, the new United States Customs House, and other commercial facilities are expected to house 50,000 office workers. In addition to businesses dealing in international trade, the Center will house substantial offices of New York State, including that of the Governor, as well as the new headquarters of the Port Authority. An integral part of this project is the Port Authority's takeover and modernization of the former Hudson and Manhattan Railroad. This had included reconstruction and expansion of the principal Manhattan terminal, located beneath the Trade Center, for the Port Authority Trans Hudson (PATH) rail transit system to and from Newark, New Jersey.

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[12] West Side Highway Project Report No. 5.20, **Open Space Opportunities for the Lower West Side of Manhattan,** November 1973.

Table 9 Existing Park and Open Space in the Study Corridor

Study Corridor Area	Existing Acreage	Population 1970	Acres Per Thousand Residents
Lower Manhattan	24.12	540	44.66
Greenwich Village	11.55	37,485	0.32
Chelsea	8.79	41,597	0.20
Clinton	8.56	41,576	0.20
Study Corridor	53.02	121,198	0.43
RPA Goal for Manhattan	72.6	121,198	0.6
Present Manhattan Average			1.42

The twin towers of the World Trade Center are nearing completion in Lower Manhattan.

Finally, two other projects on the Hudson in the Midtown area should be noted here. The Port Authority's new Consolidated Passenger Ship Terminal, at Piers 88, 90 and 92, is scheduled to open in mid-1974. Just to the south, construction is proposed to begin in 1974 on the New York City Convention and Exhibition Center, but that schedule is subject to both unforeseen legal obstacles and continuing community opposition. Although both of these are outside of the area for which this Project has prepared transportation plans, they are major public facilities to be considered in evaluating alternatives.

Population

In this Corridor context, it is helpful to present a demographic profile of the areas potentially affected by Project proposals. At present, there are approximately 121,000 people living within the Corridor, which is about eight percent of Manhattan's population, and about 23 percent of CBD residents. (See Table 10.) This is approximately 15,000 fewer people than lived in the Corridor in 1960, representing a 12-year decline of over ten percent.

This downward trend is expected to reverse during the next 20 years. Under the Project's minimum and moderate growth assumptions, respectively, the Corridor is projected to house between 169,500 and 244,000 people in 1995.[13] This represents an increase of between 40 percent and 102 percent, significantly greater than the expected increase for the CBD, while the population of Manhattan as a whole will fall slightly. The Corridor's share of total Manhattan population will rise from 8 percent to between 12 percent and 17 percent, and its share of the CBD will go up from 23 percent to between 31 percent and 40 percent.

These absolute and relative population changes are marked. They will result from the substantial residential expansion which is just now beginning on the West Side below 59th Street, and within the Corridor in particular. These are areas which have seen almost no new residential investment in many years, and which presently house relatively few people. Thus, planning for 1995 must take into account a sizeable incremental increase in population, and must accommodate the attendant residential land uses which will displace other uses during the next 20 years in this area.

Looking now to the population distribution within the Corridor, it should be noted that almost no people now live in Lower Manhattan, Community Planning District One. (See Table 11.) Because of this, coupled with the major new apartment developments going up in Lower Manhattan, this portion of the Corridor will see by far the most dramatic increases. As described in detail in the later section on Lower Manhattan, population here will rise between 80 and 100 times by 1995, as the area becomes a residential community as well as a commercial center.

The western portion of Greenwich Village within the Corridor, Community Planning District Two, presently contains one-third of the Corridor population—38,500 residents, just a shade more than in 1960. Under the Project's minimum-change growth assumption, this total is expected to rise only slightly by 1995—to 41,500, up about 8 percent. But under the moderate-change assumption, it is projected to go up over 51 percent, to a total of about 58,000.

The Chelsea and Clinton portions of the Corridor, Community Planning District Four, together comprise the most populous area. The 82,000 residents there are more than two-thirds of the Corridor population. Between 1960 and 1972, however, almost all of the population drop in the Corridor occurred in Chelsea and Clinton. Nevertheless, due to the development of new housing in those areas, it is projected that they will show between a 5 percent and 60 percent increase in population by 1995, up to between 86,000 and 131,000.

Thus, within the Corridor, Chelsea, Clinton and the West Village are expected to retain roughly the same population relationships to one another that they now have, while Lower Manhattan will show a dramatic rise compared with the other communities. Racially, the Corridor is predominantly white. While there are numerous concentrations of Irish, Greek, Italian, French and Spanish families, there are proportionately fewer Blacks and Puerto Ricans than in Manhattan as a whole. The Blacks are distributed fairly evenly within the Corridor, and their share increased moderately between 1960 and 1970. The Puerto Rican population is concentrated in the Chelsea and Clinton portions of the Corridor, and it fell substantially between 1960 and 1970.

While the Corridor contains a larger proportion of working-age people (ages 19 to 64) than does Manhattan, their number dropped from 93,000 to 83,000 between 1960 and 1970. Coupled with a decrease in the youth population, this indicates that families left the Corridor during the decade. This is explained in part by: (1) the reduction in family-sized housing units by demolition and conversion, especially in Clinton; and (2) the shift in blue-collar employment out of Manhattan. The 18,000 elderly residents of the Corridor constitute a growing number of transit-dependent individuals.

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[13] For a discussion of these growth assumptions, see West Side Highway Project Report No. 5.11, **Forecasting Methodology and Resulting Floor Area and Demographic Estimates For Use in Traffic Assignment Process**, February 1973.

Table 10 Population in the Study Corridor, Manhattan and the Central Business District

Population	1960	1970	1972	1995(a) Minimum(b)	1995(a) Moderate(c)
Study Corridor	135,880	121,198	121,000	169,500	244,250
Percent of Manhattan CBD	25.0	24.0	23.3	31.2	39.8
Percent of Total Manhattan	8.0	7.9	8.1	12.1	16.8
Manhattan CBD	544,336	505,234	520,000	544,000	615,000
Percent of Total Manhattan	32.1	32.8	34.8	38.7	42.3
Total Manhattan	1,698,281	1,539,233	1,494,000	1,404,000	1,455,000

Change in Population	1960-70		1970-72		1972-95 Minimum(b)		1972-95 Moderate(c)	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Study Corridor	– 14,682	–10.8	– 198	–0.2	48,500	40.1	123,250	101.9
Manhattan CBD	– 39,102	– 7.2	14,766	2.9	24,000	4.6	95,000	18.3
Total Manhattan	–159,048	– 9.4	–45,233	–2.9	–90,000	–6.0	–39,000	–2.6

(a) 1972 and 1995 figures are estimated.

(b) West Side Highway Project growth Assumption "B," projecting minimum change between 1972 and 1995.

(c) West Side Highway Project growth Assumption "C," projecting moderate change between 1972 and 1995.

Source: 1960 and 1970 Censuses of Population; 1972 and 1995 estimated by West Side Highway Project.

Table 11 Population in the Study Corridor and Local Community Areas within the Corridor

Population For:	1960	1970	1972	1995(a) Minimum(b)	1995(a) Moderate(c)
Lower Manhattan	723	540	500	42,000	54,600
Greenwich Village	37,743	37,485	38,500	41,500	58,250
Chelsea and Clinton	97,414	83,173	82,000	86,000	131,400
Total Study Corridor	135,880	121,198	121,000	169,500	244,250

Change in Population For:	1960-1970		1970-1972		1972-95 Minimum(b)		1972-95 Moderate(c)	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Lower Manhattan	– 183	–25.3	– 40	–7.4	41,500	8,300.0	54,100	10,820.0
Greenwich Village	– 258	– 0.7	1,015	2.7	3,000	7.8	19,750	51.3
Chelsea and Clinton	–14,241	–14.6	–1,173	–1.4	4,000	4.9	49,400	60.2
Total Study Corridor	–14,682	–10.8	– 198	–0.2	48,500	40.1	123,250	101.9

(a) 1972 and 1995 figures are estimated.

(b) West Side Highway Project growth Assumption "B," projecting minimum change between 1972 and 1995.

(c) West Side Highway Project growth Assumption "C," projecting moderate change between 1972 and 1995

Source: 1960 and 1970 Censuses of Population.

The population changes are reflected in the housing situation. Between 1960 and 1970, the Corridor showed a net loss of over 1,000 units, almost all within Chelsea and Clinton. During the same period, the number of people per household dropped continually, like the pattern for Manhattan. The Corridor contains a higher percentage of low-rental units (under $80 per month), and a lower percentage of high-rental units (over $250 per month) than does Manhattan. Significantly, the number of owner-occupied units rose in the Corridor between 1960 and 1970, reflecting the central city trend toward conversion to cooperatives, and all of this increase took place in Chelsea.

The Battery Park City site is being prepared for construction in new landfill off Lower Manhattan.

The median family income and distribution for the Corridor approximates that of Manhattan, as do the increases during the last decade. In 1969, the median family income for the Corridor was $9,320, and $7,950 for Clinton, $9,620 for Chelsea and $11,420 for the West Village portions of the area. Study Corridor incomes are expected to continue to rise, because of both the general increases in wages and the addition of new middle and upper income housing now being built or planned for the Corridor. These household and income characteristics are shown in Table 12.

Table 12 Household and Income Characteristics for the Study Corridor and Local Community Areas within the Corridor

Area	1970	1972	1995 Minimum(b)	1995 Moderate(c)	Change 1972-95 Minimum(b)		Change 1972-95 Moderate(c)	
					Number	Percent	Number	Percent
Lower Manhattan								
Population in Households	540	500	40,600	53,100	40,100	8,020.0	52,600	10,520.0
Households	307	300	22,300	29,500	22,000	7,333.3	29,200	9,733.3
Average Household Size	1.76	1.67	1.82	1.80	.15	–	.13	–
Average Household Income(a)	7,675(d)	8,825	16,325	17,275	7,500	85.0	8,450	95.8
Greenwich Village								
Population in Households	35,651	36,600	40,100	56,750	3,500	9.6	20,150	55.1
Households	21,313	22,200	25,700	36,900	3,500	15.8	14,700	66.2
Average Household Size	1.67	1.65	1.56	1.54	–.09	–	–.11	–
Average Household Income	9,325(d)	10,725	16,625	17,650	5,900	55.0	6,925	64.6
Chelsea and Clinton								
Population in Households	81,166	80,000	84,100	129,400	4,100	5.1	49,400	61.8
Households	44,065	43,600	48,400	75,300	4,800	11.0	31,700	72.7
Average Household Size	1.84	1.83	1.74	1.72	–.09	–	–.11	–
Average Household Income	8,175(d)	9,425	14,525	15,450	5,100	54.1	6,025	63.9
Study Corridor								
Population in Households	117,357	117,100	164,800	239,250	47,700	40.7	122,150	104.3
Households	65,685	66,100	96,400	141,700	30,300	45.8	75,600	114.4
Average Household Size	1.79	1.77	1.71	1.69	–.06	–	–.08	–
Average Household Income	8,550(d)	9,850	15,500	16,400	5,650	57.4	6,550	66.5

(a) Rounded to nearest $25.

(b) West Side Highway Project growth Assumption "B," projecting minimum change between 1972 and 1995.

(c) West Side Highway Project growth Assumption "C," projecting moderate change between 1972 and 1995.

(d) Represents 1969 income as reported in the 1970 Censuses of Population and Housing, and adjusted to equal total household income.

Source: 1970 Censuses of Population and Housing; 1972 to 1995 estimated by West Side Highway Project.

Employment

The Study Corridor currently provides about 444,000 jobs, approximately 18 percent of total Manhattan employment. This total is projected to rise to between 511,000 and 594,000 jobs by 1995, which would increase the Corridor's share of Manhattan to between 20 percent and 22 percent. This would add about 68,000 jobs under the Project assumption of minimum growth, and about 150,000 under the moderate growth assumption. These substantial increases are attributable to the new commercial developments in the Corridor, such as the projected 50,000 office workers at the World Trade Center and 35,000 at Battery Park City.

At present, the majority of Corridor employment, 51 percent, is located in Chelsea and Clinton, with blue-collar categories predominating. The Lower Manhattan portion has about 28 percent of Corridor jobs, primarily in offices. Greenwich Village has the smallest share, with 21 percent of Corridor employment, mostly in mixed commercial and industrial activities.

Between now and 1995, employment in the Lower Manhattan, Chelsea and Clinton areas of the Corridor is forecast to increase substantially, but to drop in the Village area. (See Table 13.) Employment in the West Village is expected to fall between 9,000 and 16,000 jobs, or 10 percent to 17 percent, because of increasing expansion of residential areas, and conversion of commercial properties. In contrast, as new commercial developments are completed, Lower Manhattan, Chelsea and Clinton will generate more jobs. The increase in Chelsea and Clinton is projected to be between 13 percent and 21 percent, or an addition of 29,000 to 48,000 jobs. Of course, the most marked rise is to be expected in Lower Manhattan, where between 55,000 and 112,000 jobs will be added by 1995, increasing that part of the Corridor's employment by between 44 percent and 90 percent.

In addition to these relative numerical changes, a general trend in job categories is evident. According to the 1970 Census, approximately 81 percent of the Corridor's working population is employed in white-collar jobs. Within the Corridor, Clinton has most blue-collar jobs, while the Village has most white-collar jobs. Significantly, the area as a whole showed a rise in white-collar employment between 1960 and 1970 similar to that of Manhattan. This important trend reflects the continuing exodus of manufacturing and wholesaling activities from the central city, and the fact that the only growth in central city employment has been occurring in offices.

A large portion of New York City meat is supplied from the Gansevoort-14th Street Meat Market, where severe street congestion occurs during business hours

Two major concentrations of employment in the Study Corridor are in meat processing, and in the printing industry. The **Gansevoort Meat Market** is located along 14th Street adjacent to West Street. This is by far the largest of the five wholesale meat markets in New York City. Approximately 150 separate firms here supply virtually all meat to Manhattan below 72nd Street, the city's greatest area of meat consumption. About two-thirds of the Market output goes to this area. The Meat Market employs directly between 3,000 and 4,500 workers, as well as several thousand more in support jobs.[14]

The meat wholesaling business is highly specialized, characterized by small firms which generally deal in one or a few kinds of meat, and which perform only one or a few functions in the overall wholesaling operation. Thus, they are extremely interdependent, and must be clustered at one location. Although the Gansevoort Meat Market is housed in scores of structures dating from the last century, its interior and equipment comply fully with Federal requirements, due to some heavy capital investment since 1967. The physical problems with the Market are due to the multi-story nature of the buildings, and to heavy traffic congestion in the area.

A few years ago, the City's planning policy was to relocate the Market away from the West Side of Manhattan. Subsequently, City policy changed to a position of allowing market forces to take their course. However, the City did lease a large site in the South Bronx to a private cooperative to build and operate a new meat wholesaling center. The first stage (700,000 square feet) of this Hunt's Point Cooperative Market is now being occupied.

There has been considerable speculation as to whether Gansevoort firms would move to Hunt's Point. The picture is mixed. Some firms have decided to go, others are committed to staying, and the balance are undecided. Although the Gansevoort Market and the Village community generally have a good relationship, and about 10 percent of the Market workers live in the Village, area street congestion and residential expansion provide problems for the Market. Housing pressures are coming from both north and south. The present narrow and irregular street system results in both inefficient operation for the market, and undesirable truck traffic on local residential streets.

Overall, the Gansevoort Meat Market appears to be viable in the short run, still benefiting from recent capital improvements. However, the present pattern of some firms moving away is expected to continue. As this trend goes on, employment now generated in the Corridor by the Meat Market is likely to decline.

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[14] For a more detailed discussion, see West Side Highway Project Report No. 5 05, **Report on the Gansevoort–14th Street Meat Market** (December 1972).

Table 13 **Employment in the Study Corridor and Manhattan**

Area	1972	1995(a)	1995(a)	Change 1972-95		Change 1972-95	
		Minimum(b)	Moderate(c)	Minimum(b)		Moderate(c)	
				Number	Percent	Number	Percent
Manhattan	2,473,000	2,583,000	2,694,000	110,000	4.4	221,000	8.9
Study Corridor	443,600	511,200	593,900	67,600	15.2	150,300	33.9
Lower Manhattan	125,500	180,100	273,200	54,600	43.5	111,700	89.0
Greenwich Village	93,000	77,300	83,700	−15,700	−16.9	−9,300	−10.0
Chelsea and Clinton	225,100	253,800	273,000	28,700	12.7	47,900	21.3
Study Corridor as Percentage of Manhattan	17.9	19.8	22.0	61.5	–	68.0	–

(a) 1972 and 1995 figures are estimated.

(b) West Side Highway Project growth Assumption "B," projecting minimum change between 1972 and 1995.

(c) West Side Highway Project growth Assumption "C," projecting moderate change between 1972 and 1995.

Source: 1972 and 1995 estimates for Manhattan by West Side Highway Project, based on a continuation of current trends as projected by Regional Plan Association and Tri-State Regional Planning Commission; 1972 and 1995 estimates for Study Corridor by West Side Highway Project.

The **printing industry,** New York City's second largest manufacturing employer, after clothing, employs almost 110,000 persons. Nearly 90 percent of this graphic arts activity takes place within Manhattan, and the majority of that share is located within or adjacent to the Study Corridor.[15]

The single greatest concentration of these interdependent firms is just south of Canal Street in an area between Broadway and Greenwich Street, known as "Tribeca," an acronym for Triangle Below Canal. Lesser concentrations occur close to Wall Street and in West Midtown.

Traditionally, these West Side areas have offered substantial advantages to a highly location-sensitive industry: low-rent space, good public transportation, access to the Hudson River tunnels, and proximity to the Midtown and Downtown publishing and financial communities.

Until 1960, the number of firms and employees engaged in printing in New York City had remained relatively stable. But between 1960 and 1970, the City lost about 5,000 printing jobs. Since 1970, this downward trend has accelerated. With an additional loss of about 12,000 jobs between 1970 and 1972, graphic arts employment in the City fell to an all time low of less than 110,000 jobs. During this same period, the nation's other major printing center, Chicago, experienced an increase of more than 11,000 jobs in graphic arts.

Although some of this decrease is attributable to technological change within the industry, and to the demise of four New York newspapers, the major cause has been the migration of firms to surrounding areas, where space for expansion and good transportation facilities were readily available at minimum cost. For many firms, the costs of doing business on the West Side, including those due to transportation congestion, have outweighed the benefits of geographical proximity to customers and suppliers.

The future direction of locational decisions within the printing industry appears uncertain. One view is that out-migration has run its course, while another perspective is that all types of printing firms will continue to relocate outside New York City. Given the size of the industry as the City's second largest employer, and its traditional concentration on the West Side, the locational choices by graphic arts firms between now and 1995 will significantly affect employment and land use within the Study Corridor.

Sketches of each of the communities within the Study Corridor follow, in order to provide a better picture of the particular areas which might be affected by alternative proposals of the West Side Highway Project.

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[15] For a more detailed discussion, see the West Side Highway Project **Profile on Printing and Publishing Industry** (July 28, 1972).

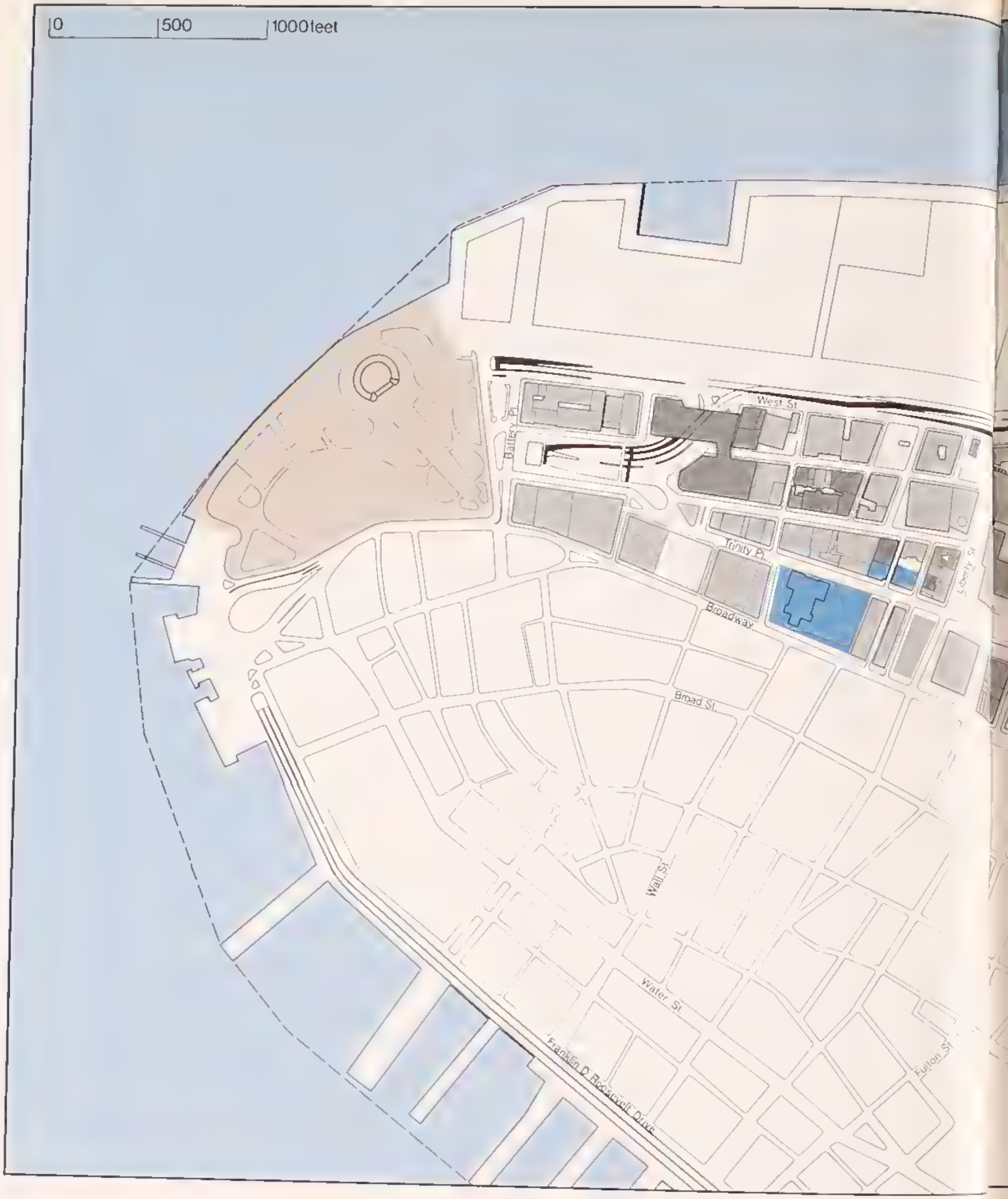
Lower Manhattan

Lower Manhattan is the irregular inverted triangle of land comprising the most southerly portion of the Island. From the point at the Battery, it spreads out along both rivers for about one and one-half miles to its northern boundary at Canal Street, which cuts across the Island diagonally from the Manhattan Bridge. Seen from the Staten Island Ferry or the Statue of Liberty in the Harbor, or from Brooklyn Heights, this area makes up the familiar postcard view of Manhattan's towering pyramid of skyscrapers.

By day, this Lower Manhattan area is the nation's financial center, housing the stock exchanges, brokerage houses and insurance companies, and the big banks and the large law firms serving the corporate community. Lower Manhattan is also the governmental hub of New York City, with City Hall and a considerable complex of local, state and Federal offices, comprising the Civic Center near the Brooklyn Bridge. The area is interlaced with retail shops at street level, and concentrated within a few major shopping areas, with some light industrial uses in the northwestern corner. By day, the area literally is teeming with people—over 400,000 bankers, lawyers, brokers, clerks, secretaries, laborers and shopkeepers. It is clearly an establishment business community.

By night, however, Lower Manhattan takes on the aura of a ghost town. Nearly no one lives below Canal Street in Manhattan. There are only about 300 housing units scattered throughout the section of the area within the Study Corridor, and it is estimated that there are only about 500 permanent residents in that area. Lower Manhattan at present is only a daytime community of employees, commuting in each morning and leaving the area each night. Consequently, essential services are strained during daylight hours, but either closed or unavailable evenings and weekends.

However, the City's planning policy for the area is to change this pattern, to gradually transform Lower Manhattan into a 24-hour community with a substantial residential population. To that end, some major housing developments are now either under way or planned in the area by several different public agencies.



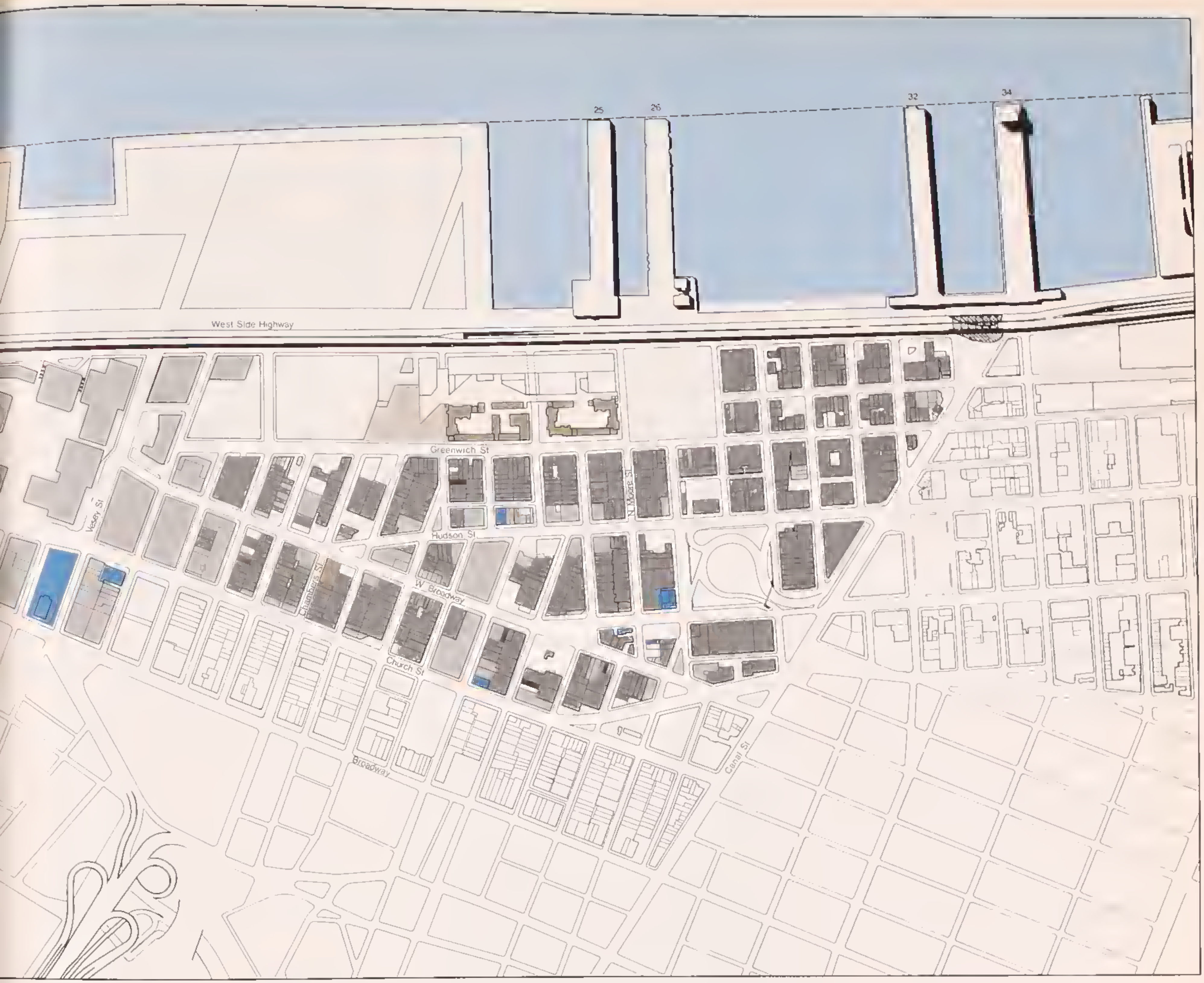


Illustration 16 Present Land Uses in the Lower Manhattan Section of the Study Corridor

Recreational
Residential
Institutional
Industrial
Commercial
North

More than 27,000 new housing units for Lower Manhattan are currently in construction or planning. In the Washington Street Urban Renewal Area, north of the World Trade Center, the first 1300 units are close to completion, and another 2000 units will be started soon. At Battery Park City, on the Hudson River landfill, construction will soon commence on the first of almost 15,000 apartments. Along the East River, the City's proposed Manhattan Landing development would provide another 10,000 apartments by the year 2000.

The West Side Highway Project has projected that these new developments in Lower Manhattan may lead to an increase of between 42,000 and 55,000 residents in the Study Corridor portion of the area by 1995. It is estimated that approximately one-third of this increase would occur between now and 1980, and two-thirds during the following 15 years. This growth would dramatically alter the character of Lower Manhattan, multiplying the present token population by between 80 and 100 times. This would increase Lower Manhattan's share of the Project Study Corridor population from less than one-half of one percent at the present, to between 22 percent and 25 percent in 1995. Significant expansion of the operations and extent of commercial facilities in the area would be required to serve the new residents, including the major investments in retailing already planned for both Battery Park City and Manhattan Landing.

A few areas of Lower Manhattan merit special description. First, the area between the World Trade Center and Battery Park has been designated by the City Planning Commission as the Greenwich Special Development District. This special district generally skirts the edge of the Wall Street financial area. It was established in order to encourage creation of a pedestrian network linking the office core with the World Trade Center, Broadway, Battery Park and Battery Park City, while providing additional open space and more accessible retail facilities.

North of the World Trade Center and east of the Washington Street Urban Renewal Area is the Chambers Street commercial area. This area is one of two recognized commercial centers in Lower Manhattan, with strong economic roots tied to the shopping requirements of the large, daytime working population. The other area is Nassau Street, which runs north and south through the heart of the financial district to the east of Broadway. With the completion of the first residential buildings in the Washington Street Urban Renewal Area, an initial enclave of housing will be permanently established within the Lower Manhattan portion of the Study Corridor. As a result, expansion of retail facilities and conversion of underutilized loft structures to residential uses are felt to be likely in adjacent areas, especially between Greenwich Street and West Broadway.

Commuters fill the Wall Street area of Lower Manhattan each day

Shannon/Associates

The scale and density of Lower Manhattan are apparent from the air.

The area north of the Renewal Area, known as the "Tribeca" (Triangle Below Canal Street), has been the subject of intensive study by both the City and the West Side Highway Project. It is characterized by deteriorating pre-1915 loft buildings now partially occupied by wholesalers and warehouse operators. A number of graphic arts firms are also located in the area. Because of its underutilization, proximity to major redevelopment projects and access to the Holland Tunnel, Tribeca possesses considerable potential for redevelopment.

There are now about 125,000 employees within the western portion of Lower Manhattan, the section in the Study Corridor. It is estimated that employment in this area will rise to between 180,000 and 237,000 by 1995. (See Table 14.) This employment analysis was based upon a division of the area into five "functional zones," each characterized by dominant current use or proposed development. The areas of the World Trade Center, the Washington Street Urban Renewal Area, and Battery Park City/Greenwich Special District are self-explanatory. The "Broadway Tier" is the area located

Table 14 **Employment in the Lower Manhattan Section of the Study Corridor**

Functional Zone	1972	1995(a) Minimum(b)	1995(a) Moderate(c)	Change 1972-95 Minimum(b)		Change 1972-95 Moderate(c)	
				Number	Percent	Number	Percent
Greenwich District/Battery Park City	48,800	60,600	98,800	11,800	24.2	50,000	102.5
World Trade Center	20,300	55,300	55,300	35,000	172.4	35,000	172.4
Broadway Tier	40,100	38,100	46,000	−2,000	−5.0	5,900	14.7
Wholesaling Area	15,500	17,100	25,100	1,600	10.3	9,600	61.9
Washington Street Urban Renewal Area	800	9,000	12,000	8,200	1,025.0	11,200	1,400.0
Total	125,500	180,100	237,200	54,600	43.5	111,700	89.0

(a) 1972 and 1995 figures are estimated.

(b) West Side Highway Project Growth Assumption "B," projecting minimum change between 1972 and 1995.

(c) West Side Highway Project Growth Assumption "C," projecting moderate change between 1972 and 1995.

west of City Hall and the expanding Civic Center, basically an office district, with some convenience shopping. Major change is not anticipated here, but some low-rise buildings are expected to be redeveloped at higher densities. The "Wholesaling Area" is the interior portion of Lower Manhattan, with dairy, dry groceries and hardware merchants. It is characterized by small, older loft structures, which appear to be destined to give way to expansion of the commercial core. As wholesalers leave, and as land values rise, construction of more office space is likely.

These projections reflect the expected further decline in wholesaling activities. But it is assumed that these losses will be more than offset by a continuing gain in office jobs, and that the current "soft" office market in the area is only a temporary phenomenon. However, given the serious problems, especially in transportation, associated with a Lower Manhattan location, which have been described earlier, this projected increase may be overly optimistic. Yet, the presence of a large local residential community will provide Lower Manhattan with an important new employment resource.

Inasmuch as Lower Manhattan does not now have many residents, the interested busines community and City offices must be looked to for local concerns and desires. The objectives of Community Planning District One and the City of New York have been expressed through the **Lower Manhattan Plan** (1966), the **Plan for New York City** (1969), and various plans of the New York City Office of Lower Manhattan Development. Inputs have also been made by private organizations, such as the Downtown Lower Manhattan Association.

The common thrusts of their objectives are: (1) to strengthen the financial and civic centers: (2) to redevelop the waterfront for public use; (3) to create a viable 24-hour community in Lower Manhattan; and (4) to retain service and industrial uses in the Tribeca area. Of primary importance is alleviation of vehicular congestion and the improvement of local pedestrian and traffic circulation in Lower Manhattan.

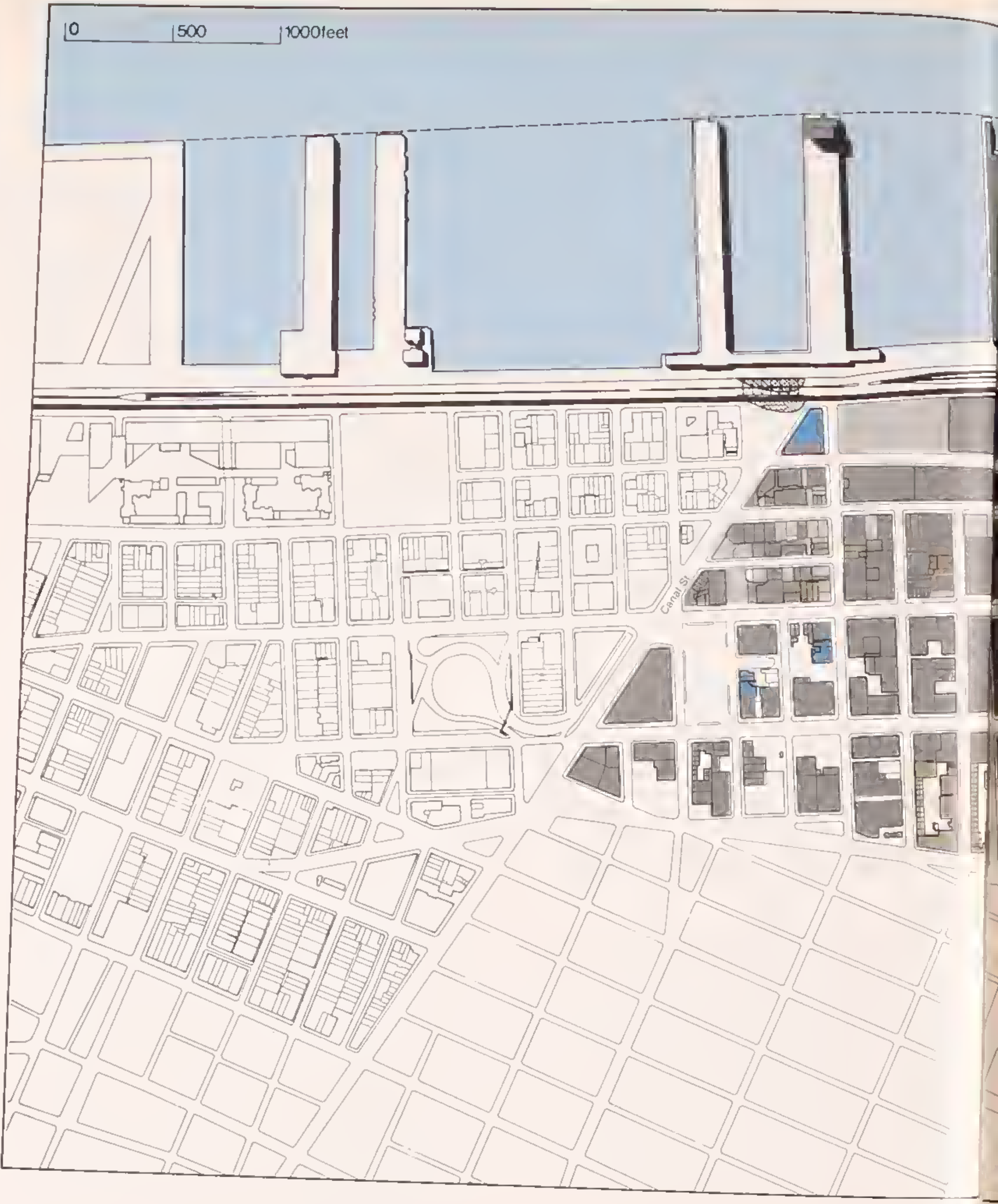
In light of existing conditions, the accomplishment of two of these goals may be difficult to achieve. First, without a concerted public effort, it will be difficult to retain service and industrial uses in Tribeca. This area has already become the focus of intense real estate pressure for non-manufacturing uses, and this trend is expected to continue. Second, new construction along the Hudson and East Rivers in Lower Manhattan will introduce additional sources of automotive and pedestrian congestion into an already highly developed area. Unless such construction is accompanied by new facilities to accommodate this traffic, the present transportation situation will deteriorate further.

Greenwich Village

One of the oldest and best known communities in Manhattan, Greenwich Village is also the largest of three residential areas adjacent to the existing West Side Highway. It extends from the Canal Street industrial area to the commercial shops of 14th Street, occupying a strategic location between Manhattan's Downtown and Midtown employment concentrations. The western edge of this land-locked community is separated from the waterfront by a corridor of underutilized industrial property, the existing elevated West Side Highway, and run-down or empty Hudson River piers.

Since its origin as a small settlement on the outskirts of Dutch New Amsterdam, the Village has been a haven from the city for city people. The physical character associated with this tradition is preserved within the old-world atmosphere of the Greenwich Village Historic District, created by city law, while the unique vitality of the area has always been tied to the changing composition of the resident population. Now more than ever, the Village is noted for its diversity in terms of income, interests and lifestyles. A well founded reputation as a favored area for artists, writers and musicians has been supplemented by an influx of young professionals and people with established wealth. Over the past decade, increases in population and median personal income have helped to redefine the Village as the fifth most affluent community in the City. Its specialty shops, restaurants and entertainment facilities represent an important economic asset to Manhattan, and its well organized residents have melded themselves into a potent political force. More than any Study Corridor community, the Village has the ability to shape and control both its present conditions and its future growth.

The western portion of Greenwich Village is the only Study Corridor area in which the population is currently growing. Further, the area's housing stock increased by more than 3000 units between 1960 and 1970, while its population remained stable during that decade. Some of these units come from new construction like the West Village Housing Project, but the bulk are the result of converting existing townhouses to studio apartments, and loft spaces to residences. Yet, the rate of such construction and conversion has been too slow to meet housing demand in the area. This has resulted in residential conversion in neighboring communities, residential expansion into industrial loft districts, and a thrust of housing toward the West Village waterfront. With the highest rent structure on the Lower West Side and a low vacancy rate, demand continues for more housing than presently is being supplied in the West Village area.



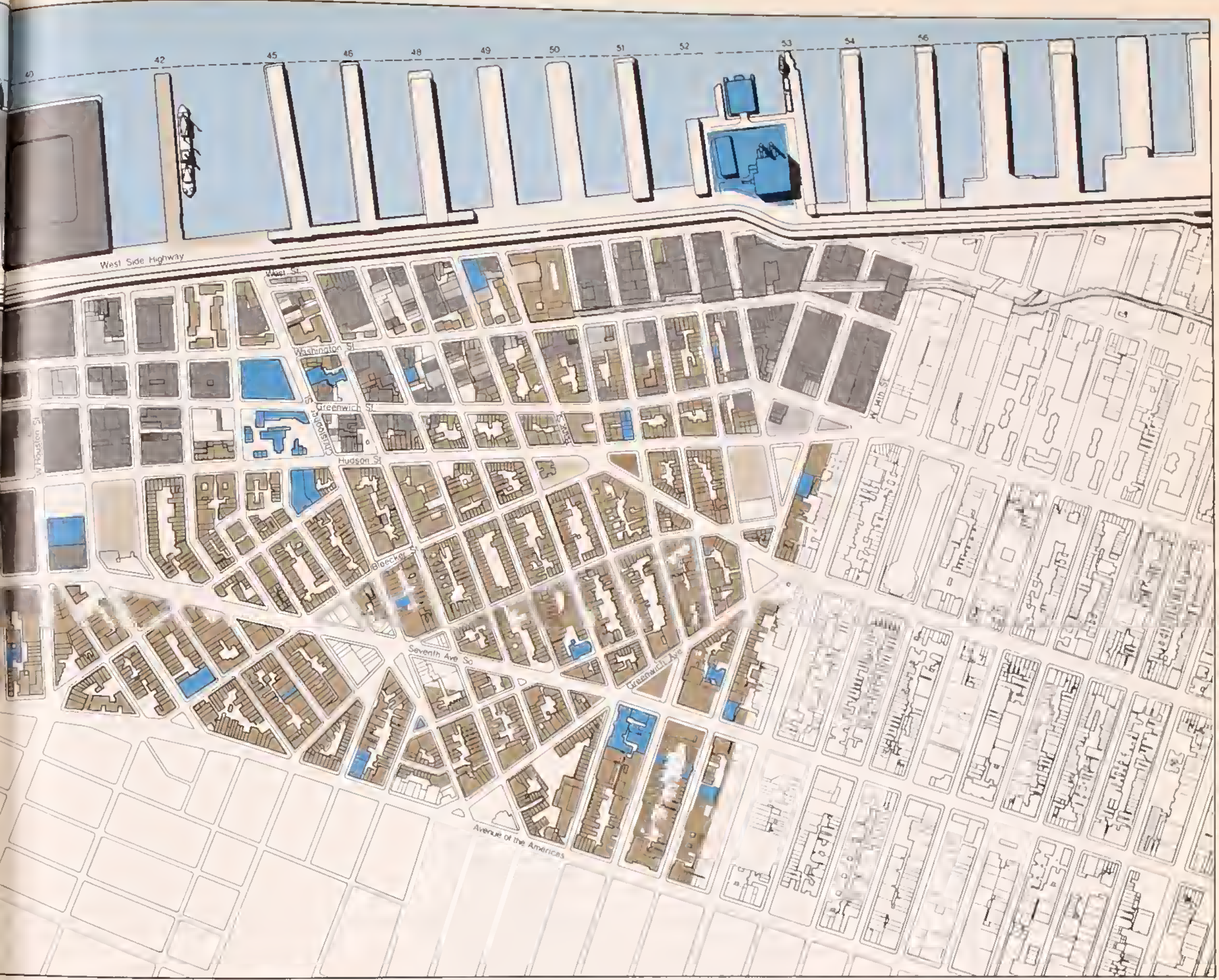


Illustration 17 Present Land Uses in the Greenwich Village Section of the Study Corridor

▭ Recreational
▨ Residential
🟦 Institutional
■ Industrial
▩ Commercial
— North

Some residential and commercial expansion of the West Village has been into adjacent manufacturing areas, like that known as "SoHo," (South of Houston Street). But such change has been subject to City policy aimed at the preservation of blue collar employment. A special Landmark Zoning District was established by the City for SoHo, which permits limited conversion of vacant, low-rent lofts to residential uses, while requiring the preservation of architecturally significant buildings. In spite of such conditions, this trend is continuing.

The great demand for places to live in the West Village has stimulated the housing market in adjacent communities, chiefly Chelsea just to the north across 14th Street, where townhouses are being rapidly renovated or converted to apartment units. Such renovations and conversions for upper-income people are widespread along some streets in Chelsea, forcing many low and moderate-income residents out of these areas.

Finally, the West Village waterfront has come under intense pressure for residential redevelopment. The circumstances and issues surrounding the expansion of housing toward the waterfront are particularly relevant to this analysis, since both the existing West Side Highway and the West Village community play an important role.

At one time, the West Village piers, the elevated West Side Highway, and a narrow strip of industrial property between West and Hudson Streets formed a functional relationship which was typical of waterfront activity along the entire Hudson River from Battery Park to 70th Street. Break-bulk cargo flowed beneath the Highway from piers to back-up warehouse space across West Street. Many of the dock workers lived nearby, forming strong ties between each section of the waterfront and adjacent residential areas. With the subsequent decline in West Side maritime commerce, much of the waterfront became functionally obsolescent, and vacant or decayed. Waterfront property adjacent to the existing Highway is deteriorating and dotted with vacant lots, and devoted sometimes to marginal uses unrelated to the River. The elevated Highway acts as a physical and visual barrier to the waterfront, and represents a hazard to pedestrians who must walk under its crumbling superstructure.

In addition, certain less tangible factors could either stimulate or constrain future reuse of the area adjoining the River. The waterfront lies outside the Historic District boundaries, and it is the only sizeable underdeveloped piece of real estate left in the West Village.

A Greenwich Village residential street serves both as a playground for children . . .

Thus, the waterfront area is a scarce commodity in a location with inherent real estate potential. Compared to adjacent residential areas, waterfront property values are relatively low. On the other hand, residential redevelopment is impeded by the presence of empty and decaying piers and a deteriorating elevated highway, and an unproven housing market in an area restricted by current zoning and some extensive private land assemblages. The waterfront by nature has never enhanced the residential qualities of neighboring communities, but the rapid deterioration of existing facilities, coupled with the uncertainties of redevelopment, has caused concern within the West Village over the future of this area.

The West Village, between Greenwich Street and Seventh Avenue, is one of the most desirable residential areas in the City. Here old townhouses on narrow, diagonal streets are mixed with high-rise apartment buildings along the avenues. Neighborhood shops and well known restaurants add to the charm of this quality urban environment. Few areas in the City can claim the human scale of the West Village, and still maintain a highly urban character. These unique conditions did not happen of their own accord, nor will they continue unchallenged in the future. Local residents, by means of block and neighborhood organizations, have fought hard for and have won concessions from both the public and private sectors. To a considerable extent, these people have purposefully controlled the evolution of their environment.

and route for trucks

In the 1950's, the West Village already had started to expand in the direction of the waterfront. Following traditional patterns of industrial displacement, deteriorated buildings and old row houses near the Gansevoort Meat Market were skillfully rehabilitated. A residential wedge was finally driven all the way to West Street in 1970, with the conversion of the former Bell Telephone Laboratories into Westbeth, housing and working space for about 400 artists and their families. To the south of Westbeth, where sound buildings were scarce and much demolition already had occurred, the private real estate market was less active. Although speculation has escalated property values, public renewal was necessary in order to assemble land and obtain zoning changes which were prerequisite for new construction. Unlike privately initiated conversion and rehabilitation, the renewal process generated strong opposition from the West Village community.

The original renewal plan covered a 14-block site and called for high-rise apartment buildings, commensurate with land costs in the area. This scheme, vehemently opposed by local residents, was approved by the City Planning Commission in 1961. After direct confrontation between the community and City Hall, the plan was rejected by the Mayor and the Board of Estimate, representing the first defeat of a City renewal plan by a militant local community. A community organization, called the West Village Committee, then came forth with its own redevelopment plan, and proposed that a community housing corporation sponsor its project. This plan was approved by the City and given Mitchell-Lama financing by the State in 1969. After 12 years of sustained effort, 420 cooperative apartments in 42 five-story walk-up buildings are near completion.

The West Village is characterized by quiet residential streets and small shops

Although conversion and rehabilitation of existing waterfront structures are preferred by Village residents, new construction in the West Village is inevitable. Based on the local talent, organization and endurance that were demonstrated in the West Village Housing Project, the community is well equipped to shape the form and character of any new development proposal. In preparation for this eventuality, a waterfront development study was commissioned by Community Board Two in 1970.[16] This report defined the goals and policies for a longe range waterfront planning program, paying particular attention to preservation and extension of existing community character, and revitalization of the river-edge for community recreational purposes.

City policies, because of previous encounters with local opposition, and an assessment of maritime commerce, correspond closely with these community goals and objectives. The **Plan for New York City** states that "preservation of the unique quality of the Village is the key to contemplated public action."[17]

Both the Community Board and the City have submitted policy guidelines to the West Side Highway Project.[18] These policy statements further emphasize local priorities within the West Village for accommodating future development within the framework of existing patterns:

"The Waterfront shall be conceived as an extension of the immediately adjacent neighborhoods . . . and shall not compete with those areas, but rather complement their orderly growth and development. An acceptable corridor development plan must maximize recreational opportunities at the waterfront for public usage . . . as a network of open spaces and facilities relating to the adjacent communities."

[16] **Greenwich Village Waterfront Study**, Stage One Report, Beyer, Blinder & Associates, 1970.

[17] **Plan for New York City**, Vol. 4 (Manhattan).

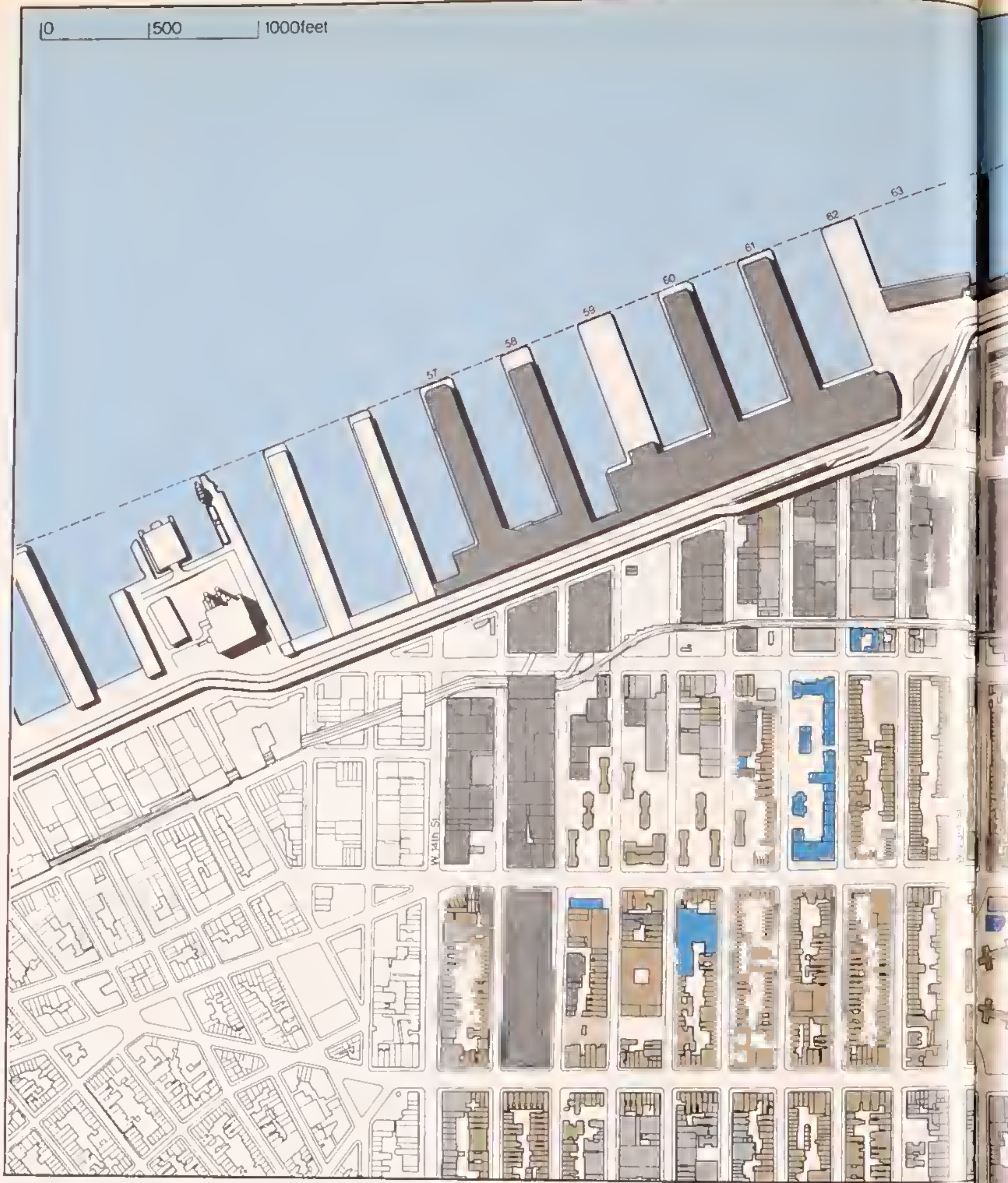
[18] New York City Policy Statement to the West Side Highway Project Steering Committee, 1972.

Chelsea

The Chelsea portion of the Study Corridor lies immediately north of Greenwich Village between 14th and 30th Streets, from Sixth Avenue to the Hudson River. Geographically, the area consists of a core residential enclave of nineteenth century brownstones and row houses surrounded by light manufacturing and transportation activities. When New York City was still a small town clustered around the Battery several miles to the south, Chelsea was a remote country estate. In the 1820's the first waves of urban growth moved north up Manhattan, encompassing Greenwich Village and eventually the serene country setting of Chelsea as well.

Until the 1940's, Chelsea was a pleasant and unusually handsome area characterized by well-kept buildings, sidewalk gardens and tree-lined streets. The waterfront area, with its warehouses, railroad yards and piers was one of the most active sections of the port. The 14th Street railroad spur provided direct connections to prospering industrial buildings along Tenth Avenue, and employment was at its peak. The elevated West Side Highway served the community with access ramps at 23rd Street. On the eastern side of the community, a large light manufacturing district characterized by five to ten story loft buildings constituted the heart of Manhattan's industrial base. Here small firms in the apparel, furniture and printing industries flourished, providing an ample supply of blue collar jobs within close proximity of all Corridor communities.

But by 1950, Chelsea had lost nearly all traces of its earlier glory. After accommodating successive waves of European immigrants, many of its brownstones and row houses had become overcrowded, run-down rooming houses. Waterfront break-bulk cargo operations were succumbing to the pressures of containerization and competition from modern facilities elsewhere in the Port. And, finally, transitions in Manhattan's economic orientation from manufacturing to service industries were eroding neighboring loft districts and key sources of employment. Deterioration of the residential area had reached the point where an urban renewal proposal in the 1950's simply called for the demolition of the community.



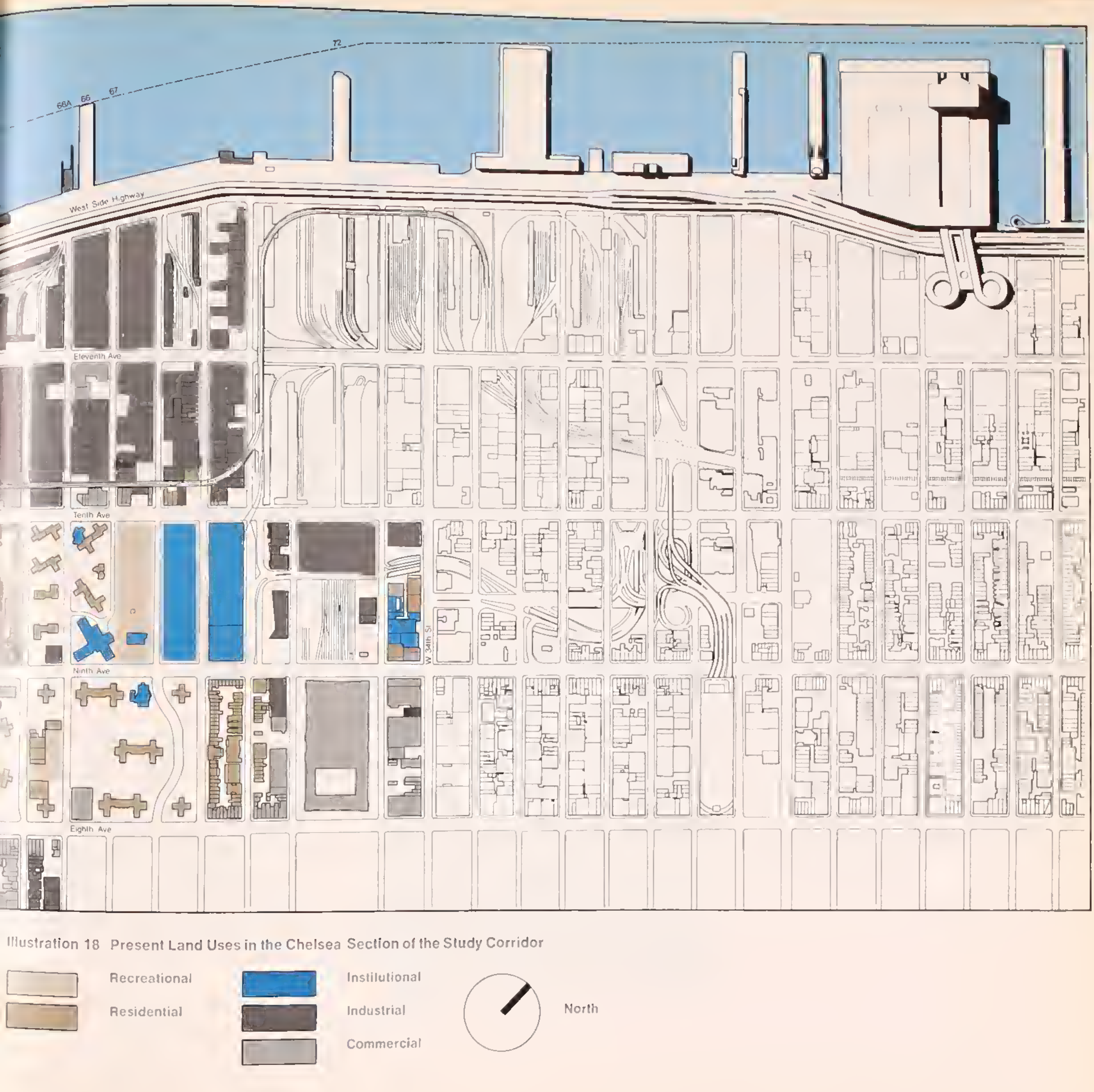


Illustration 18 Present Land Uses in the Chelsea Section of the Study Corridor

▭ Recreational

▨ Residential

🟦 Institutional

■ Industrial

▩ Commercial

North

In recent times, trends in housing and employment provide an overall assessment of existing conditions in Chelsea. Declines in population over the past decade, changes in the racial and income composition of the community and shifts in the geographic distribution of area residents are all directly tied to these trends.

Since 1960, there has been significant public or publicly aided housing construction in the community. At the northern edge of the area, Penn Station South, a middle-income housing project sponsored by the United Housing Foundation, provides 2820 cooperatives. Chelsea and Fulton Houses, built by the New York City Housing Authority, provides over 1300 units of needed low-rent housing. Unfortunately, the construction of these 4120 units required the demolition of approximately 5800 low-rent units.[19] At the same time, Chelsea's run-down and low-priced brownstones attracted both upper-income home seekers and some small-scale developers. Such private initiatives, encouraged by the City Neighborhood Preservation Program, are serving to stabilize the existing housing stock, but with serious consequences for low-income residents of the area.

In response to rising demand for middle-income and luxury housing in the neighborhood, massive renovation and conversion of the existing housing stock has occurred, resulting in displacement of lower-income residents. Brownstone renovations usually consisted of a duplex apartment on the garden and parlor floors, and several income-producing units on the upper floors. Row-house conversion usually resulted in two studio or one-bedroom apartments on each floor. While this trend preserved the existing housing stock and substantially reduced the number of overcrowded and substandard units in the community, Chelsea residents did not benefit from the transition. In addition, much of this renovation has been shoddy and may well result in short term deterioration.

Chelsea is the site of considerable public housing constructed during the 1960's.

These changes have precipitated a decline in the total number of housing units of about 2500 since 1960, and a decline in population of approximately 4300. The significance of these declines is dramatized by their impact on the low-income minority group population.

Over 6500 low and moderate-income units were demolished or converted during the 1960-1970 period, while only 1500 replacement units were provided. Estimates of units per income category for 1970 reflect the following percentages and changes from 1960:

Type of Unit	Percentage of Total Units in 1970	Change 1960-197
Low and Moderate Income	55	25 percent less than 196
Middle Income	17	Almost triple the 1960 figur
Luxury	23	Double the 1960 numbe
Unclassified	5	

Source: Hart-Krivatsky-Stubee, **Chelsea Action Planning Program**.

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[19] **Chelsea Action Planning Program**, Hart-Krivatsy-Stubee, p. 36.

n defense of their community, local residents generally seek to retain, rehabilitate and increase the residential housing stock in the area without relocation or undue inancial strain on local inhabitants. New construction s desirable if demolition and the assemblage of large development sites is to be avoided, and if rents are tailored to the income mix of the existing population. Given these criteria, additional housing within existing community boundaries is unlikely, and expansion of the community into adjacent areas will also be difficult. Attempts to develop conventional high-density housing to the east ot Chelsea have been discouraged by the City because of encroachment on blue collar, job-intensive industries. Expansion to the north is prevented by solid government and commercial uses, to the south by Greenwich Village, and to the west by the 14th Street elevated rail spur and strong community desire to retain this area, known as the Chelsea Triangle, for industrial development and the return of maritime commerce.

These adjacent areas, especially the waterfront, account for most of job opportunities available to Chelsea's non-professional population. However, due to declines in waterfront activity and city-wide losses in manufacturing, the number of jobs available, particularly for unskilled and semiskilled workers, is declining. For this reason, a major community goal is to revitalize and encourage the growth of the existing area industrial base.

Activities in the major industrial buildings in the Chelsea Triangle, such as Starrett-Lehigh, the Port Authority Building and the Manhattan Industrial Center have changed from port-related activities to "for-hire" trucking, back office activities, light manufacturing and storage of canned goods for many large food store chains. Despite the fact that much of the available space is underutilized, the need for such warehouse facilities will continue to exist, since many firms do not own and operate their own support facilities and depend upon public warehousing for storage purposes.

The future of this area is also tied in part to the future of the Chelsea Piers, which have been inactive since soon after their reconstruction in the late 1960's. Although some area residents advocate residential and recreational use ot the Chelsea Triangle and pier areas, the International Longshoremen's Association local strongly opposes any action that might render the piers and backup space unusable. At the outset ot the Project, City policy emphasized the public investment in the piers, and the need for compatibility of transportation and redevelopment alternatives for these areas. But the City subsequently modified its policy, on the basis of new re-use proposals for the Triangle, and the City's recent agreement to terminate the leases on the piers held by United States Lines. Currently, the City considers these areas as places of potential change, possibly for residential uses.

The two small railroad yards to the north of 23rd Street face similar uncertainties, due to dwindling operations. City policy tor this area is one of land conservation, in line with local interest in retaining employment opportunities. Such a policy suggests redevelopment of the area as a center for municipal services, including trucking, warehousing and vehicle servicing. However, if these yards were redeveloped in line with community residential objectives, these parcels would provide prime sites for new housing.

Renovation of brownstones and rowhouses in Chelsea is widespread today.

The Chelsea Triangle is an area of mixed uses, and underutilized commercial and industrial facilities.

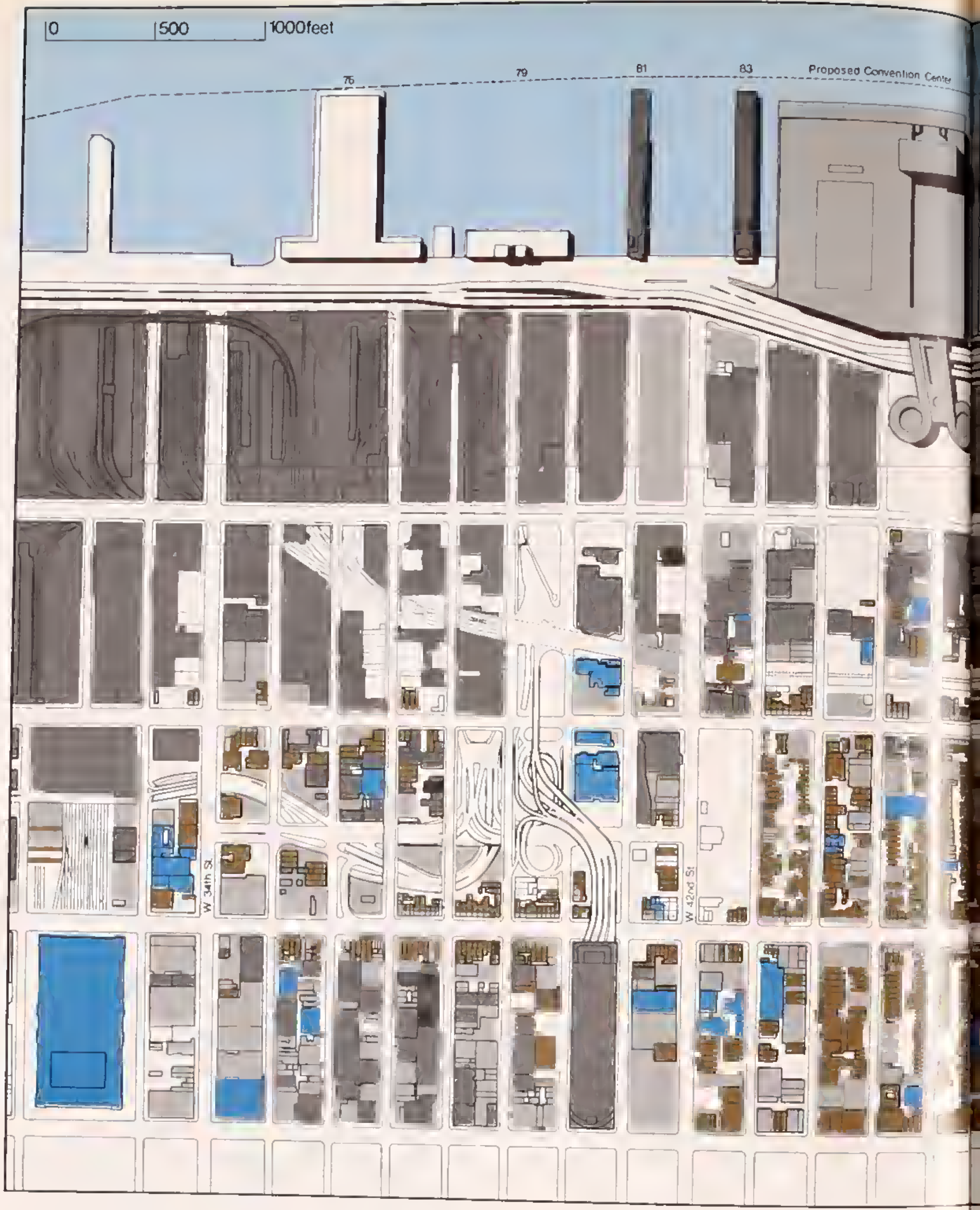
Clinton

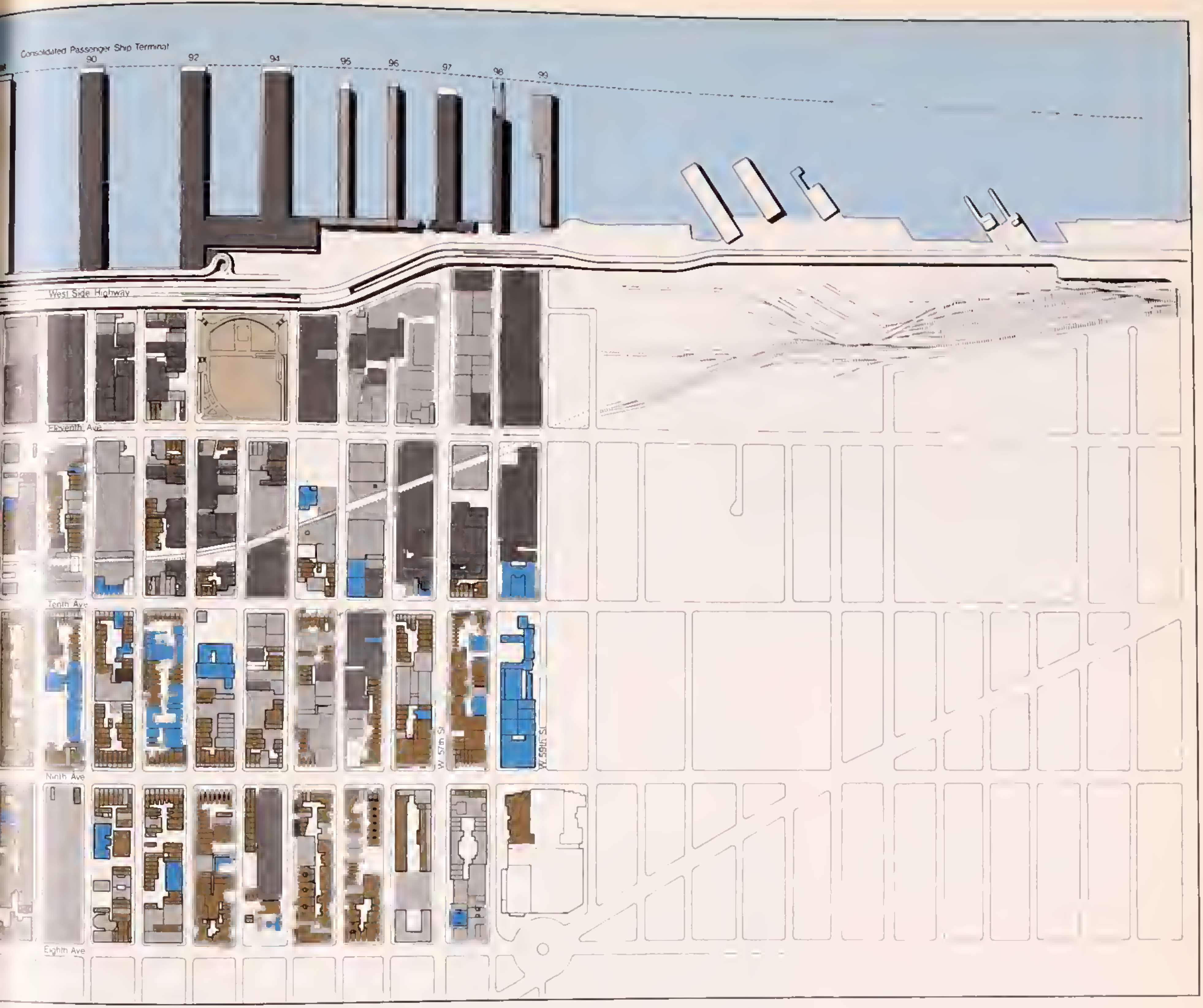
Clinton is located on the western fringe of the Midtown business district between Eighth Avenue and the Hudson River, from 30th to 59th Streets. The origins of this community are tied to waterfront and transportation oriented activities which sprang up along the West Side during the 1850's. Soon after the arrival of the Hudson River Railroad, and the establishment of slaughter houses, glue factories and a gas works in the area, residential tenement structures begain to emerge amid the smoke and congestion. Despite these undesirable conditions, the community grew rapidly due to the influx of European immigrants who were mostly penniless and eager for work. By the turn of the century, the crowded tenements and crime, along with the unsavory industry, had earned Clinton the title of "Hell's Kitchen," one of the worst slums in the City.

Over the past 60 years, the dramatic rise of the Midtown business district and the construction of major transportation facilities in the area (Penn Station in 1910, Lincoln Tunnel in 1930 and Port Authority Bus Terminal in the 1950's), coupled with the decline of waterfront commerce and industrial activities, have gradually enhanced the value of the community as a location for offices and middle and high-income residences. Recent large scale projects on the Hudson River, such as the proposed new Convention Center and the Consolidated Passenger Ship Terminal, are helping to complete a redefinition of the community from the "backyard" of Midtown to a potentially prime business or residential district.

Today, Clinton is no longer considered a slum. However, because of extensive demolition and real estate speculation, the area has lost much of its former cohesion, to the point where its very existence as a community is being threatened. What remains is a fragmented residential area from 41st to 59th Streets between Eighth and Tenth Avenues, surrounded by a wide variety of competing, non-residential land uses.

The present residential portion of Clinton represents only one-third of the total land in the community and is characterized by deteriorating walkup apartments interspersed with "temporary" parking lots (sites which have been assembled and cleared for future construction), small business enterprises and vacant land. Under intense redevelopment pressures from Midtown and other adjacent areas, old residential neighborhoods continue to contract due to widespread demolition, with no construction of relocation housing in the area.





llustration 19 Present Land Uses in the Clinton Section of the Study Corridor

▨ Recreational
▨ Residential
▨ Institutional
▨ Industrial
▨ Commercial

North

A typical Street in Clinton shows both current conditions in the community and its relationship to Midtown

The northern portion of Clinton falls within the spectrum of two large institutional facilities, Fordham University and Lincoln Center. Because these institutions have tended to generate new commercial development, as well as high-rise housing, they pose a real threat to the existence of older Clinton neighborhoods.

To the south lies one of the principle transportation districts on the West Side. This area is dominated by the Penn Central 30th Street Railroad yards, truck, bus and commuter terminals, and the access-road network for the Lincoln Tunnel. Also, between Eighth and Ninth Avenues is the western third of the Garment District.

The area west of Tenth Avenue is mainly devoted to light industrial uses, including automotive, wholesaling and warehousing activities. Several graphic arts, metal working and food processing establishments are also found here, as well as a number of film processing firms in the 50's, west of Ninth Avenue.

In the midst of these industrial uses is DeWitt Clinton Park, which is the focal point for the Clinton Urban Renewal Area, where three major residential developments are planned. Along the waterfront, the Consolidated Passenger Ship Terminal and the proposed Convention Center have already generated considerable private redevelopment interest in adjacent properties.

Land is being assembled and buildings demolished in Clinton for temporary parking and potential new development.

The northwest corner of Clinton is bordered by a Con Edison Generating Plant and the Penn Central 60th Street Yards. A below grade Penn Central right-of-way located between Tenth and Eleventh Avenues links the 60th Street and the 30th Street rail yards.

According to the 1970 Census, approximately 41,000 people live in Clinton. Most residents live in low-rent, walkup tenements which constitute the bulk of the existing housing stock.

Although predominantly white, the community continues to maintain an ethnic variety representative of earlier days when many Irish, German, Russian and Italian enclaves existed in the area. Twelve percent of the current population is Puerto Rican; this is the largest single ethnic group. More blue collar workers live in Clinton than in any other place within the Study Corridor, and, overall, residents earn less per family than in other areas of the Corridor.

The future of the Clinton community is uncertain due to the proliferation of large real estate tracts which are cleared and awaiting redevelopment. Except for the Clinton Urban Renewal Area, where firm commitments have been made for low, middle and upper-income housing, the remaining assembled sites are owned by a few private developers, whose development proposals are necessarily based on market conditions.

Until recently, it was assumed that these areas would be developed with high-rise office buildings, a westward extension of the Midtown business district. However, in the last few years, the market for office space has fallen off. Developers who have tracts in the area have been awaiting clearer definition of the market before committing themselves to specific plans. The Convention Center and Passenger Ship Terminal are major factors currently influencing developers to feel that the area may become a viable location for hotels and for high-rise residential buildings.

Until these economic forces become more clearly defined, and final plans are developed for the tracts which are now vacant or being used as parking lots, the future of the community will be uncertain.

In terms of recreation facilities, Clinton has the least park space of any Study Corridor community—8.56 acres. Moreover, 74 percent of this space is contained in one facility, DeWitt Clinton Park's 5.83 acres, which is largely inaccessible to the existing residential neighborhoods. There are no waterfront recreation facilities, aside from the privately owned Circle Line tours, operating from Piers 81 and 83 at the foot of 41st Street. These excursion boat tours around Manhattan and up the Hudson River are commercial operations, and are regional rather than community attractions.

Based on historic trends and existing conditions, it is evident that the existing Clinton community is currently engaged in a fight for survival. Not surprisingly in an area where only one percent of the property owners actually live on their property, Clinton residents have often been powerless in the face of real estate speculation. Until recently, the type of redevelopment projected for the community was largely determined by outside, non-resident interests. This situation was exemplified by the **Plan For New York City**, which singled out Clinton as a "logical" area for future expansion of the Midtown business district. Largely in response to proposals contained in this plan for a cross-town 48th Street transit facility and an attendant "commercial spine" linking the proposed Convention Center to the Midtown commercial area, Clinton residents organized and expressed strong opposition. As a result, these proposals were dropped, and it now seems clear that westward expansion of the business district is unlikely in the near future.

The community now seeks to preserve the low-cost residential character of its neighborhood and to participate in the planning of all facilities that will affect the area. In addition, the community fears potentially adverse transportation and environmental impacts of major new facilities currently being constructed or planned for the West Midtown area, notably the Consolidated Passenger Ship Terminal and the Convention Center. The major concern is that these projects will generate an influx of vehicular traffic into the community, especially on days of peak operation of both facilities.

Clinton residents have cited the following as potential impacts of these two waterfront projects: increased air and water pollution; clogged traffic circulation and heavy visitor parking on residential streets; rising taxes and rampant real estate speculation; an impetus to large-scale commercial development; and a steady draining away of municipal services from the residential neighborhood.

The Clinton Planning Council's Save Clinton Committee, organized early in 1972, responded directly to these concerns by studying and presenting alternatives, outlined in a two-part **People's Plan for Clinton.** The most important proposals contained in that plan include the following:

1. An alternative site for the Convention Center. over the 30th Street Penn Central Yards.
2. A new Flushing Line extension subway loop to provide cross-town mobility in the Midtown area, in lieu of a 48th Street "people mover" transit system.
3. The termination of any new Hudson River rail tunnel in Penn Station, rather than in a new terminal constructed on the old Madison Square Garden site.
4. The designation of the area south of 42nd Street and west of Dyer Avenue as a potential high-density commercial "Clinton Development Area," to replace the proposed 48th Street "commercial spine."
5. Detailed recommendations for improving local bus service and traffic control.

The Clinton Towers Urban Renewal Project is now under construction at Tenth Avenue and 55th Streets.

In March 1973, in an attempt to break the deadlock over local opposition to the Convention Center and to inaugurate a more community-responsive planning process, the Chairman of the New York City Planning Commission presented a six-point plan to members of Community Board Four. Major aspects of the plan included:

The new Convention Center is proposed for a site on the Hudson River between 44th and 48th Streets

1. Development of a neighborhood preservation program for the area between Eighth and Eleventh Avenues, and 43rd to 56th Streets, with City implementation funding of up to $15 million over the next three to five years.
2. A study to develop an improved traffic and transportation plan for the new Convention Center.
3. Commitment of funds to begin construction of public housing in the Clinton Urban Renewal Area, and City efforts to include an acceptable number of low and moderate income units in all future Mitchell-Lama housing projects in the community.
4. Abandonment of the current proposal for a high-density commercial spine between 47th and 49th Streets.
5. Funding the site and design of an elementary school in the area of 44th Street and Tenth Avenue.
6. Denial of all requested zoning changes for commercial and luxury residential purposes between 43rd and 56th Street and Eighth and Eleventh Avenues, for a minimum of one year.

Community Board Four has approved this proposal, but has refused to endorse construction of the Convention Center until there is tangible evidence that the plan for the protection and improvement of the Clinton community is developed and satisfactorily implemented. Several elements of this plan are currently underway: construction has begun in the Clinton Urban Renewal Area; a traffic study of West Midtown is now being conducted by the Transportation Administration; and the possibility of a special waterfront development district between Eleventh and Twelfth Avenues, and 41st to 58th Streets, is under joint investigation by the Office of Midtown Planning and Development, and Clinton community groups. In approving the plan for the Convention Center recently, the Board of Estimate imposed a one year moratorium on new construction in the Clinton area. In August 1973, the City Planning Commission approved the designation of Clinton as part of the newly created Neighborhood Preservation/Rehabilitation Program.[20] This action will probably lend financial and administrative support to community desires for stability.

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[20] **Neighborhood Preservation in New York City,** Comprehensive Planning Workshop, New York City Planning Commission, October 1973, p. 76.

The Environment

The preceding sections have summarized the economic and social conditions which currently prevail on the West Side of Manhattan, and those expected to prevail in 1995, particularly within the areas which have been the subject of special study by the West Side Highway Project. This section deals with three basic components of the physical environment—air, noise and water.

As part of its planning process, the Project has undertaken analyses of both present and projected noise conditions, air quality and water quality on the West Side. The discussion here includes a description of the particular public policies relating to each environmental concern, some background information on the sources and effects of each type of pollution, and a summary of existing environmental conditions on the West Side of Manhattan.

This information on present and projected environmental conditions is presented as an aid to understanding the probable environmental effects of each Project proposal. The discussion of such an evaluation of the air, noise and water aspects of the Project alternatives will be presented later, in Section 4 of this report. And, in keeping with the purpose of this Environmental Impact Statement, this material is presented for reading by the general public, free of undue technical content. However, all of the background information, scientific observations and supporting findings are available for public review in a series of technical reports covering the air, noise and water studies of the West Side Highway Project.

Air Quality

When the word "environment" is mentioned, most people think immediately of air pollution. In recent years, air quality and the intensive programs now underway to improve this component of the environment have been the subjects of much discussion and controversy.

The West Side Highway Project has undertaken an extensive study of air quality as it relates to the Project alternatives and to their predicted impacts on the environmental quality of the Project study area and the New York Region. The full scope and findings of that study are contained in a separate technical report. To understand the significance of this study, it is important to comprehend the recent developments in federal and state requirements for air quality, the emphasis which they place upon the control of automotive sources of air pollution, and their relationship to the West Side Highway Project.

In 1970, the Congress enacted a series of amendments to the Clear Air Acts of 1963 and 1967. These amendments imposed stringent national standards designed to reduce significantly emissions of air pollutants from mobile sources, including autos and other motor vehicles, by the years 1975 and 1976. Emission standards set limits on the amounts of various pollutants emitted from such mobile sources. Due to the energy crisis, these deadlines for compliance have been set back by Congress.

In addition to the highly publicized emission standards which motor vehicle manufacturers must meet, the amendments also provide that the states must submit to the Federal Environmental Protection Agency (EPA) plans for implementing the Federal ambient air quality standards for designated air quality control regions. These ambient air quality standards set limiting levels for the concentration in the air of certain pollutants. New York City's five boroughs constitute a major part of one of these regions.

The Transportation Controls section of the New York City Metropolitan Area Air Quality Implementation Plan was submitted by the State of New York to the Federal EPA in April 1973, and has since been approved. In an effort to assure that two areas of Federal policy would not be in conflict, the Federal Highway Act provides that the Secretary of Transportation shall assure that highways constructed with Federal funds will be consistent with the approved Air Quality Implementation Plan for any designated region.[21] The West Side Highway Project is funded under the Federal Interstate Highway Program and, therefore, has responded within its planning process to those strategies outlined in the Air Quality Implementation Plan which bear directly on the planning and design of a new transportation facility in the West Side corridor.[22]

The New York City plan contains a number of transportation control strategies aimed at meeting the Federal air quality standards by 1975-76. It is important to keep in mind that any West Side Highway Project alternative would not be in operation until after 1980, and therefore would not directly affect the achievement of the standards in the mid-1970's. However, these strategies have long-range effects regarding the level of use of automotive vehicles in the region and the maintenance or improvement of air quality in the future. These long-range effects and the manner in which they are incorporated into the Project's planning process and air quality study have been the subject of detailed discussion with the New York City and New York State agencies responsible for implementing and enforcing air quality standards.

The relationship of the Project to the Implementation Plan depends upon the way in which the existence and operation of the Highway contribute to both the overall objectives of the plan and the successful achievement of the specific implementation strategies. Both of these measures of consistency of the Project proposals with the Implementation Plan are discussed in detail in the air quality portion of the probable impacts section of this Statement.

Total vehicle emissions of air pollutants are directly related to the number of vehicle-miles traveled and to the speed of travel. Congestion and the consequent slowdown of the traffic flow cause higher pollution levels. These primary stage strategies are aimed at reducing the amount of (or in the case of after-hours truck deliveries, the time of) vehicle miles traveled within the City The desired goals are to reduce automobile usage and to improve the speed of flow of those vehicles which continue to operate. The strategy of after-hours truck deliveries addresses a slightly more subtle point—that of removing this component of traffic from the streets during periods when congestion is most likely to occur, and having delivery vehicles operate during periods when free-flow conditions, and therefore less pollution, are possible.

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[21] **United States Code**, Title 23, Section 109 (j).

[22] **New York City Metropolitan Area Air Quality Implementation Plan Transportation Controls**, New York State Department of Environmental Conservation, April 1973.

Highways and Air Pollution

Any urban highway obviously influences the air quality of the region. Various phenomena may occur cumulatively upon any highway facility, some of which lower air quality and some of which improve it. First, a highway may attract new motor-vehicle trips that would not otherwise be made on alternative facilities, thereby contributing to increased generation of pollutants. Second, a highway, by its very existence as a transportation facility, may encourage the development of land use that would not otherwise occur, thus raising pollution, and contributing to increased motor-vehicle trips, with a concomitant increase in pollutant emissions. But, third, a new highway may attract motor-vehicle trips from existing highway facilities or streets which are more congested and slower, thereby decreasing pollutant emissions. And a highway may attract motor-vehicle trips to a transportation corridor, thereby concentrating pollutants and permitting better control or dissipation of them.

These influences are not mutually exclusive, and all may operate concurrently. This possibility means that no simple statement claiming either that all highways increase or that all highways decrease urban air pollution is correct. It is therefore necessary to examine each case in order to determine the contribution of each of the influences described above. Such an analysis must include a careful study of the land-use characteristics of the impact area, the traffic generated under alternative development patterns, and the resultant changes in air quality for each of the land-use and transportation alternatives. Such a study has been a principal concern of the West Side Highway Project

Vehicular Pollutants

The five vehicular source pollutants of prime concern are carbon monoxide, hydrocarbons, nitrogen oxides, particulates including lead, and secondary pollutants, such as oxidants, contained in photochemical smog. Several factors govern the severity of their effects. Among these are the level of pollutant exposure or its concentration, the duration of the exposure, the general environmental conditions (for example weather conditions), the varying susceptibilities of individuals, and the amount and type of interaction among two or more pollutants.

Carbon monoxide (CO) is a colorless and odorless gas. Most of the carbon monoxide in the atmosphere is produced by the incomplete combustion of fossil fuels used for vehicles, space heating and industrial processing, or materials burned as refuse. Transportation activities account for the major portion of carbon monoxide emissions. Most people are aware that carbon monoxide in sufficient concentrations can cause death. However, it should be noted that these conditions rarely occur except in situations when the pollutant is produced in large quantities in an enclosed space, such as a garage. In the urban environment, carbon monoxide levels are far below those which cause death. However, continual exposure to relatively low levels of carbon monoxide can cause unpleasant physical effects, such as dizziness or headaches. The effects of carbon monoxide on man vary with its concentration, as follows:

Concentration (a)	**Condition** (b)
10 ppm	No Significant Hazard
100 ppm	Dizziness and Headache
1000 ppm	Death

(a) Parts per million (ppm).
(b) These effects are highly dependent upon the length of exposure and the susceptibility of the individual.
Source **Guide for Air Pollution Episode Avoidance**, Environmental Protection Agency, No 80-76, Washington, D.C . June 1971

Hydrocarbons (HC) constitute a class of compounds containing hydrogen and carbon in various combinations. Gaseous hydrocarbons at concentrations normally found in the atmosphere are not toxic, but they are major pollutants because of their role in forming photochemical smog. Transportation sources account for more than half of the hydrocarbon emissions each year. Hydrocarbons and nitrogen dioxide react in the presence of sunlight to form photochemical smog. The physical effects of this type of pollution are eye irritation and breathing difficulty. Other effects include damage to vegetation, deterioration of building materials and decreased visibility.

Nitrogen oxides are produced when fuels are burned at high temperatures. There are a number of oxides of nitrogen. However, only two—nitric oxide (NO) and nitrogen dioxide (NO_2)—are emitted by motor vehicles into the atmosphere in significant quantities. Nitric oxide is not an irritant, and is not considered to have any adverse effects at concentrations found in the atmosphere. However, varying amounts of nitric oxide are converted to nitrogen dioxide. Nitrogen dioxide is a yellowish-brown, pungent gas with a sweetish odor. It is one of the components in the formation of photochemical smog, as discussed above.

Particulates include particles of solid or liquid substances in a wide range of sizes, from those that are visible as soot and smoke to those too small to detect except with a microscope.[23] For the most part, the effects of particulates on health are related to injury to the human respiratory system. Particulate matter can cause damage to a wide range of materials, through soiling or abrasion.

Oxidants are the major class of compounds found in photochemical smog. They are formed by the reactions of hydrocarbons, nitrogen dioxide and sunlight, which are described above. Oxidants are the principal cause of eye and lung irritations attributed to photochemical smog.

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[23] **Environmental Quality, First Annual Report**, Council on Environmental Quality, August 1970, p. 63

National Air Quality Standards

As mentioned earlier, the Federal Environmental Protection Agency has established "National Ambient Air Quality Standards" which must be met by 1975-76. These standards are shown in Table 15. The EPA has established two types of standards: "primary" standards, which protect the public health; and "secondary" standards, which protect against effects on soil, vegetation, water, visibility, materials and other aspects of the general welfare. These standards take into effect the duration of exposure to each type of pollutant, since high levels of a pollutant may exist for short periods of time but, if they are quickly dispersed, may have little or no effect. Therefore, the time periods noted in Table 15 are an important factor.

Project Air Quality Study

The West Side Highway Project has undertaken a comprehensive program to assess the impact of the Project alternatives on both the local and the regional air quality.

The objectives of this program are summarized as follows:

1. To determine existing air quality at various locations in the Project study area—specifically, the concentration levels of carbon monoxide and the emissions of non-methane hydrocarbons, oxides of nitrogen and particulates.

2. To predict the impact of the highway alternatives on the air quality of the Project study area—specifically the emissions and pollutant concentrations for carbon monoxide at critical locations. These emission levels and concentrations are based on the pollution generated by the traffic projected for the years 1982 (two years after the opening of any new facility) and 1995 (the design year).

3. To recommend possible alternative alignments or design modifications (for example, roadway covering and ventilation, and buffer zones), in order to satisfy the National Ambient Air Quality Standards for all land use areas and to avoid deterioration of existing conditions.

4. To determine the relationship between the Project alternatives and the New York City Metropolitan Area Air Quality Implementation Plan to assure that the alternatives are consistent with the Plan as required by Federal law.

Table 15 National Ambient Air Quality Standards

Pollutant	Primary Standard			Secondary Standard		
	Parts per million	Milligrams per cubic meter	Micrograms per cubic meter	Parts per million	Milligrams per cubic meter	Micrograms per cubic meter
Carbon Monoxide						
Maximum 8-Hour Concentration(a)	9	10		9	10	
Maximum 1-Hour Concentration(a)	35	40		35	40	
Hydrocarbons						
Maximum 3-Hour Concentration(a)	0.24		160	0.24		160
Nitrogen Oxides						
Annual Arithmetic Average	0.05		100	0.05		100
Photochemical Oxidants						
1-Hour Maximum(a)	0.08		160	0.08		160
Particulates						
Annual Geometric Mean			75			60
Maximum 24-Hour Concentration(a)			260			150

(a) Not to be exceeded more than once a year.

Source: 40 Code of Federal Regulations 50; 36 Federal Register 22384 (November 25, 1971); 36 Federal Register 25678 (September 14, 1973).

For purposes of the air quality study, the Project corridor was divided into two impact areas—a primary impact area, and a secondary impact area, which are shown in Illustration 20. The primary impact area includes all areas of existing or potential land use which would be directly affected by emissions from vehicles traveling on the existing or a reconstructed West Side Highway or its service roads. The western boundary of this area is at the United States pierhead line; the eastern boundary generally lies about 200 to 300 feet east of West Street/Twelfth Avenue. The secondary impact area is the region which would be affected by changes in traffic occurring due to the provision of a new or modified transportation facility in the Study Corridor.

The Measurement Program Measurements of automobile generated pollutants were made at three types of locations in Manhattan:

1. **Primary sites along the existing West Side Highway.**

2. **Secondary sites along arterial streets east of the West Side Highway, in the secondary impact area.**

3. **Tunnel sites at entrances and exits to the Lincoln and Holland Tunnels, and along feeder streets to and from the Tunnels and the West Side Highway.**

The location of each measurement site is shown in Illustration 20 These sites were selected in consultation with the New York City Department of Air Resources. Pollutant measurement requirements were determined from the national air quality standards established by the Federal Environmental Protection Agency. Suitable monitoring equipment was chosen based on consideration of accuracy, continuous monitoring capabilities and current indicated acceptance by the EPA, it is described in detail in the technical report on air quality studies.

Four **primary sites** located along the existing West Side Highway were chosen for extensive air quality and meteorological measurements. At all of the primary sites, land-use activity was of relatively low sensitivity; activities were mainly industrial, warehousing, shipping, and parking. At each of the four primary sites, towers were erected and sensors suspended over the roadway Data collection was perfomed within a 35 foot long trailer which housed the instruments. Measurements were made 24 hours per day, seven days per week for approximately three weeks at each site. At each primary site location, multiple probes were used so that simultaneously 13 measurements were made for carbon monoxide, two for nitrogen oxides, two for hydrocarbons, one for methane, two for meteorological parameters (wind and air temperature), two for total particulates, and one for particulate lead. The traffic volume and speed for each lane of the highway was also recorded.

Fifteen **secondary sites** chosen primarily on the basis of adjacent land use sensitivity, as well as geographic and vehicular source distribution, were monitored in the secondary impact area. These secondary sites were located east of the West Side Highway. They were selected along arterial streets that would be most affected by the West Side Highway Project alternatives. They included locations along main arteries and feeder streets, plus monitoring points near particularly sensitive areas such as schools, hospitals, churches and parks.

Six tunnel sites were chosen through field surveys of those potential sites that were expected to yield maximum pollution values. Sites were selected on both entrance and exit streets, and at varying distances from the portals of the Holland and Lincoln Tunnels.

Following consultation with the New York City Environmental Protection Administration and the Regional Office of the Federal EPA, it was decided that **hydrocarbon and nitrogen dioxide measurements** would not be considered on a site-by-site basis, but, rather, would be considered in terms of their contribution to the region-wide levels of these pollutants. This is because the major polluting effect of these emissions is their role in the formation of photochemical smog. The oxidants which are produced are the results of the reaction of hydrocarbons and nitrogen dioxide in the presence of sunlight, this reaction characteristically takes several hours. The prevailing winds carry the pollutants several hours downwind of the source before the photochemical reaction actually produces smog. Because of these characteristics, the attempt to evaluate the impact of these pollutants on a point-by-point basis is considered to be less meaningful than their evaluation on the basis of their contribution to the formation of photochemical smog in the region as a whole. The importance of this decision for the West Side Highway Project is in the evaluation of the impacts of the proposed alternatives which is discussed in Section 4 of this report.

Air pollutants over the existing West Side Highway were measured during the Project testing program

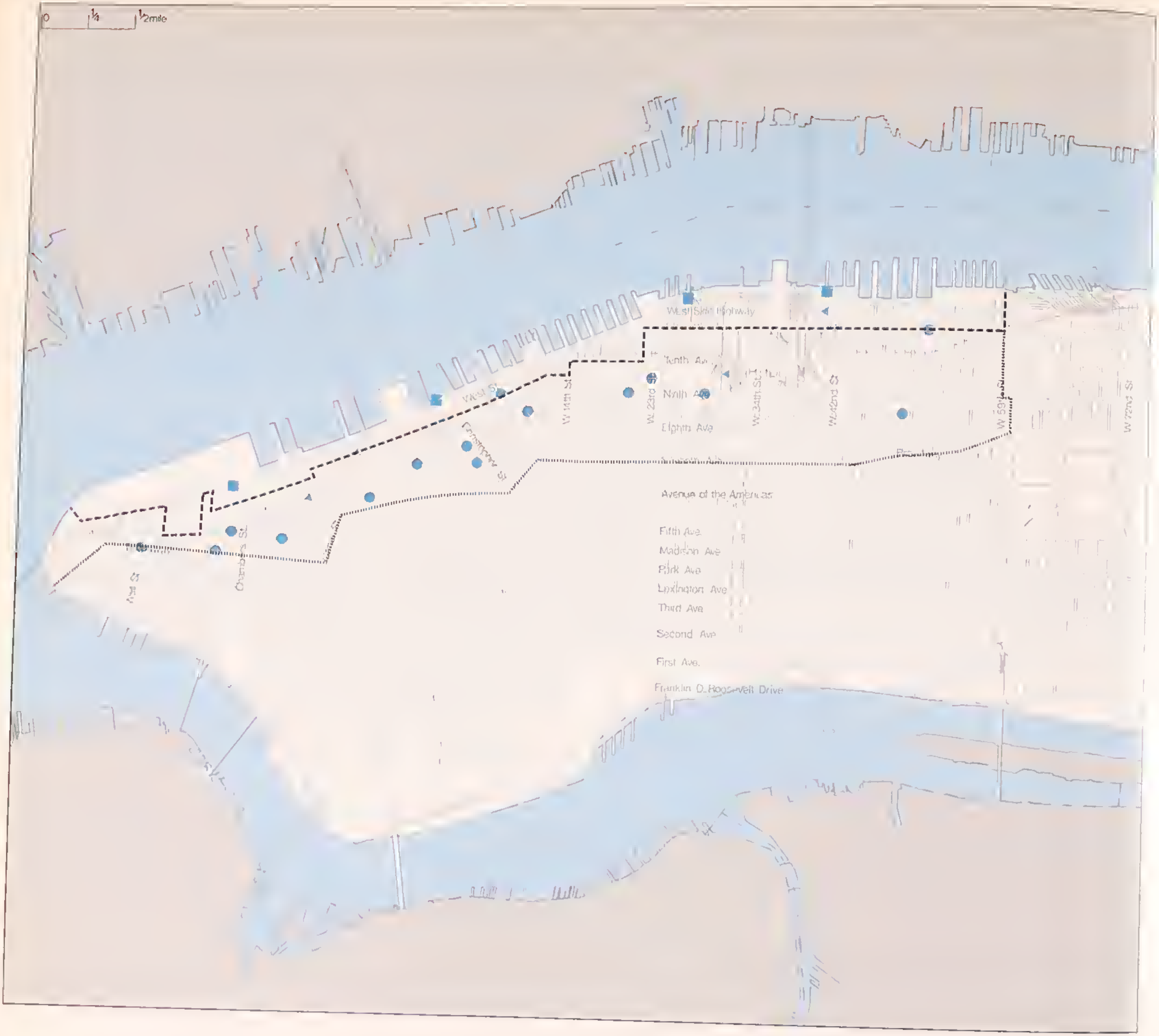
0
1/4
1/2 mile
West Side Highway
West St
Tenth Ave
Ninth Ave
Eighth Ave
Seventh Ave
Avenue of the Americas
Fifth Ave
Madison Ave
Park Ave
Lexington Ave
Third Ave
Second Ave
First Ave
Franklin D. Roosevelt Drive
Broadway
Christopher St
Chambers St
W 14th St
W 23rd St
W 34th St
W 42nd St
W 59th St
W 72nd St

Illustration 20 Air Quality Study Impact Areas and Measurement Sites

■	Primary Site
●	Secondary Site
▲	Tunnel Site
- - - - -	Limits of Primary Impact Area
··········	Limits of Secondary Impact Area
↗	North

Present Conditions

Meteorological and Topographical Features The meteorological characteristics of the New York Region, insofar as they affect the air transport of pollutants into, within and out of the Project study area, may be summarized as follows.

New York City and, in particular, the Project study area, are affected primarily by weather conditions approaching from a westerly direction. Pollutant sources across the Hudson River may, therefore, contribute to the air quality in the study area. Similarly, western Long Island, including Brooklyn and Queens, would receive more significant impact from the downwind transport of pollutants emitted by major sources within Manhattan than would the northern and western suburbs.

The New York airshed exhibits the same relatively good good ventilation properties which characterize the Atlantic seaboard as a whole, due to the relatively high average wind speeds and the absence of nearby mountain ranges, such as those which impede pollutant transport in North American Pacific coastal cities.

Significant variations in wind speed and direction are observed throughout the City and within Manhattan. The prevailing westerly winds in the primary impact area are consistently stronger than those measured simultaneously at Central Park, despite the higher altitude above ground level (11 feet versus 40 feet) of the instrument at the latter site. Wind speeds in the secondary area, however, appear to be much lower than the Central Park readings, with directions influenced primarily by local geometry, and bearing little resemblance to any definable "ambient."

Ground-based inversions, as determined by temperature soundings at La Guardia Field over a limited time span, occur primarily during early morning and late evening hours, rarely coinciding with peak traffic periods. An inversion occurs when the surface air is cooler than the air layer above it, and cannot rise and mix. The result is that any pollutants in the surface air are trapped, cannot diffuse, and pollutant concentrations near the ground increase. In Manhattan, the tendency for an inversion to form is impeded by two factors: increased air turbulence caused by the overall surface "roughness" of the landscape, resulting from the presence of numerous tall buildings; and heated surface air, caused by the heat retained by large paved areas (the urban "heat island" effect). Estimates of atmospheric stability levels in the highly urbanized study area, as determined by the standard deviations of wind direction and elevation, indicate that such ground-based inversions occur far less frequently in the study area than at La Guardia Field, an open site.

New York City, with only one of its five boroughs located on the mainland, represents an unusual situation of a central city interrupted by numerous waterways, while the suburban areas are relatively contiguous. Manhattan itself is an island, with the result that vehicular access points are limited and therefore receive high traffic volumes. For this reason, extensive analysis and field measurements at the two major West Side access points in the study areas, the Holland and Lincoln Tunnel sites, were included in this study.

The study area includes land in both Midtown and Downtown. Both of these areas are characterized by deep street canyons, as well as half-canyon or "step configurations"—that is, a building on one side of the street with an open lot on the other. The "valley" area in between contains lower, often irregularly shaped buildings. The primary impact area north of the World Trade Center is characterized by numerous warehouses, mostly under five stories, garages and parking lots.

Tall buildings play an important role in blocking the transport of gaseous pollutants emitted from the existing elevated Highway, and in setting up stagnation zones where these pollutants can accumulate. On the other hand, these structures increase the overall surface roughness, thereby assisting in the breakup of air inversions.

Primary Impact Area The maximum carbon monoxide, particulate and lead concentrations measured at each of the four primary sites are shown in Table 16. The maximum hourly carbon monoxide concentrations do not exceed the National Ambient Air Quality Standard for one-hour—35 parts per million (ppm)—at any of the four sites. The highest measured one-hour concentration is 6.2 ppm at 41st Street. The eight-hour concentrations exceed the 9 ppm Federal standard at three of the four primary sites. Again, the highest concentration occurs at 41st Street, and exceeds the standard by a factor of 1.9

Particulate concentrations exceed the Federal standard only at the 41st Street site. The other three primary sites have particular concentration below the 260 microgram per cubic meter level set by the standards

There are no Federal standards for lead concentrations at this time, but values greater than two micrograms per cubic meter have been considered by the Federal EPA to be excessive. This value is exceeded at both the Murray Street and 41st Street sites.

The highest values of measured pollution concentrations are found in all cases at the 41st Street site. It is believed that the local street traffic generated by the Lincoln Tunnel and by the travel between the Tunnel and the existing West Side Highway, along with extensive automobile and bus parking in the area, account for these higher levels of pollution.

Table 16 Maximum Air Pollutant Concentrations Measured at Primary Area Sites

Site	Hourly CO(c)	8-hour CO(c)	24-hour Particulate(d)	24-hour Lead(d)
1 Murray and West Streets	21.2(a)	11.8(a)	254	4.09
2 Christopher and West Streets	12.1(a)	7.8(a)	128	1.57
3 27th Street and 12th Avenue	23.0(b)	9.2(b)	252	1.75
4 41st Street and 12th Avenue	26.2(b)	17.0(b)	658	5.43

(a) 10-foot level.

(b) 6-foot level.

(c) Parts per million.

(d) Micrograms per cubic meter.

Secondary Impact Area Table 17 shows the maximum carbon monoxide, particulate and lead concentrations for each of the 15 secondary sites. The maximum one-hour carbon monoxide concentrations do not exceed the Federal standards at any of the secondary sites. The maximum concentration found at any of the sites was 30 ppm at the site on Broadway between Pine and Wall Streets. This level is 14 percent below the 35 ppm Federal standard. The eight-hour standard of 9 ppm was exceeded during the measuring period at nine of the 15 sites. The highest eight-hour concentration recorded was at Broadway between Pine and Wall, and was 2.4 times the standard.

Particulate standards were exceeded at four of the 15 sites, with a high of 343 micrograms per cubic meter, which exceeds the 260 standard by a factor of 1.3. Eight of the 15 sites had lead concentrations greater than two micrograms per cubic meter.

Project air quality measurement sites included the Manhattan approach to the Holland Tunnel

The levels for carbon monoxide measured on the West Side of Manhattan in the secondary site areas appear to be lower than those measured by the New York City Department of Air Resources at the critical Manhattan locations on the East Side. These locations include the plaza of the Queensboro Bridge and certain intersections along Park Avenue in the Forties. In general, pollution appears to be lower on the West Side of Manhattan than on the East Side. These lower levels of concentration may be attributed to the lower traffic volumes on the West Side, and the greater ventilation of the West Side due to the proximity of the Hudson River and the prevailing westerly winds off the River.

Tunnel Sites Carbon monoxide concentrations for the Holland and Lincoln Tunnel sites are shown in Table 18. The Lincoln Tunnel area generally shows greater pollution than the Holland Tunnel area. This is probably due to the greater ventilation of the Holland Tunnel plaza, which is open and not surrounded by tall buildings. None of the tunnel locations have measured one-hour carbon monoxide levels that exceed the Federal standards. All of the Lincoln Tunnel sites and the Broome Street site at the Holland Tunnel show maximum pollution levels that exceed the eight-hour standards.

Table 17 Maximum Air Pollutant Concentrations Measured at Secondary Area Sites

Site Location		Hourly CO(a)	8-hour CO(a)	24-hour Particulate(b)	24-hour Lead(b)
1 Broadway and Park Place	City Hall Park, Highly commercial	15.0	11.0	223	NA
2 Broadway between Pine and Wall	Highly Commercial	30.0	22.0	343	0.66
3 Church between Leonard and Worth	NYU Law School; commercial, light industry	12.4	8.3	306	0.64
4 Varick between Domonick and Broome	Chelsea Vocational School, residential, commercial, light industrial	28.2	20.4	219	0.78
5 Houston between Varick and Hudson	Maritime High School; playground, light industry	9.4	7.0	184	0.56
6 7th Ave. and Grove	Light industry, some residential	7.6	5.0	223	2.02
7 Hudson and Grove	School, Church, highly residential	12.5	8.8	100	3.05
8 Washington and Bank	Highly residential; moderate commercial	10.0	7.5	191	2.52
9 8th Ave. and W. 12th	Highly residential; small park area	4.5	3.3	99	2.42
10 9th Ave. between 20th and 21st	Theological Seminary, highly residential	15.0	12.0	297	2.88
11 9th Ave. between 27th and 28th	Clinic, Church, School, highly residential	18.2	14.8	218	7.29
12 23rd between 9th and 10th Ave.	Highly residential	13.9	10.4	297	4.95
13 30th between 8th and 9 th Ave.	Hospital; highly residential	17.4	15.5	101	4.58
14 50th between 8th and 9th Ave.	Hospital; highly residential	10.8	9.6	105	1.77
15 11th Ave. between 52nd and 53rd	DeWitt Clinton Park; light and heavy industry	22.6	16.0	163	1.86

(a) Parts per million.
(b) Micrograms per cubic meter.

Table 18 Maximum Carbon Monoxide Concentrations Measured at Tunnel Sites

Site	Location	Hourly(a)	8-hour(a)
1 Holland #1	Hudson and Ericsson Streets	14.7	7.6
2 Holland #2	Canal and Washington Streets	9.7	8.5
3 Holland #3	Broome Street	20.0	11.2
4 Lincoln #1	30th and Dyer Streets	13.5	9.1
5 Lincoln #2	42nd Street and 11th Avenue	28.0	13.7
6 Lincoln #3	41st Street between 11th and 12th Avenues	14.0	12.7

(a) Parts per million.

Noise Conditions

A significant component of the environment of an urban area is noise. In recent years, it has come to be accepted that noise, commonly defined as unwanted sound, presents a real barrier to an individual's ability to operate effectively in and to enjoy his living environment. Many types of sound are difficult to classify as noise, simply because what constitutes "unwanted" sound varies greatly among individuals. To the stereo buff, maximum volume while playing a record may provide the utmost enjoyment of the music; to his next-door neighbor, the sound is noise. However, one element of urban noise which is generally regarded as unwanted is traffic noise. This is the type of noise which is the primary concern of the West Side Highway Project.

In recent years, there has been increasing awareness of highway and traffic noise as an environmental pollutant. Programs to study and ultimately reduce the effects of traffic-related noise have been instituted on local, state, and federal levels. These programs have ranged from local codes prohibiting the honking of horns to noise level standards for Federally-aided highway projects.

The West Side Highway Project has conducted an extensive study of the traffic-related noise within the Project Study Corridor. The purpose of the study was two-fold: first, to determine existing noise levels and their relationships to the existing West Side Highway and local traffic conditions; and, second, to provide a basis for predicting the noise of the highway alternatives under study. Both of these are used to evaluate the noise impacts of the study alternatives in light of the changes from existing conditions which each would produce.

This section is meant to give the reader insight into this generally recognized but little understood type of pollution through a discussion of noise and its effects on people, and the standard unit for measuring noise. The section also includes a discussion of the standards which have been developed by the Federal government for noise levels associated with highways, and concludes with a description of the West Side Highway Project noise measurement program and the existing noise conditions in the study area. A more detailed discussion is contained in the technical reports on the Project's noise study

There are many elements comprising noise pollution in an urban area such as New York City. Some of these elements are by-products of activities which are essential to the health, safety and welfare of the city's inhabitants, including noise from emergency vehicle sirens, from garbage collection operations and from construction and repair equipment. Other elements, such as noise from subway and elevated rail transit lines, and highway and traffic noise are by-products of the movement of people and goods, activities which are essential to the continued viability of the city as a place to live and do business. Although these and many other noise producing activities are necessary to a city, the noise they produce is definitely undesirable. Urban noise levels detract from the amenity of the living environment, and there is increasing evidence that such excessive noise represents a threat to the public health[24]

The current public concern over noise can no longer be dismissed. A good proportion of the urban population experiences distressing psychological conflicts, and the addition of severe noise exposure to the other strains of urban life compounds the problem.

The effects of excessive noise are of three principal types: *physical effects*, such as hearing loss, and the accumulated effects of prolonged sleep loss; *behavioral effects*, such as interference with speech, learning, and sleep, and *subjective effects*, described by such words as annoyance, nuisance, dissatisfaction and disturbance.

"The most common and best understood physiological effect of noise is hearing impairment—either temporary or permanent. The amount of permanent hearing loss produced by sufficient exposure to high-level noise depends upon the nature of the noise, the time distribution of particular exposures, the total duration of the exposure over a lifetime, and individual susceptibility."[25] The noise levels produced by traffic sources generally are not high enough to produce permanent hearing impairment. However, when the noise is abrupt or startling, such as a truck backfire or a loud engine accelerating rapidly, the common physical reactions associated with fright occur—in particular a constriction of the smaller arteries, and increases in blood pressure, saliva and gastric juices.

Physical effects also occur if noise interrupts or prevents sleep. Many city dwellers find that it is taking longer to get to sleep, that sleep is disturbed or interrupted nearly every night, and that they still feel tired when they awake in the morning. It is probable that the cumulative physical effect of a lack of adequate sleep is damaging to most people.

Current studies of behavioral effects of noise show clearly that urban noises increase irritability and discomfort, cause severe nervous tension, loss of ability to concentrate, cause impaired aptitude to perform even simple tasks, and result in loss of sleep. Another obvious effect of urban noise is interference with communication. "In a highly intellectual, technical society, speech communication plays an extremely important role. . . . In excessive noise, formal education in schools, occupational efficiency, family life styles, the quality of relaxation, and the enjoyment of life can all be adversely affected. Interference with speech communication by noise is among the most significant adverse effects of noise on people. Free and easy speech communication is probably essential for full development of individuals and social relations. . . ."[26]

In the same report, the Federal Environmental Protection Agency concluded that "there is a need for improved and comprehensive efforts at all levels of government for environmental noise control."

New York City responded to the need for noise abatement by passing a Noise Control Code in 1972. The Code is designed to replace the piecemeal approach to noise control which had existed "with a body of regulations that will not only apply specific limits wherever feasible, but will also define and maintain general noise standards for geographical areas of the city, so that noise can be prevented as well as abated in an orderly and systematic fashion."[27]

The United States Congress has responded to the need for highway-related noise control by requiring, in the Federal Highway Act of 1970, that the Secretary of Transportation promulgate standards for highway noise levels compatible with various land uses.[28] Such standards were developed by the Federal Highway Administration and are set forth in the Administration's Policy and Procedure Memorandum 90-2, published in draft form in April 1972 and in final form in February 1973. The Act further requires that new, Federally-aided highways include in their planning and design adequate measures to allow them to meet these noise level standards It is within the context of these Federal regulations that the West Side Highway Project noise study has been carried out.

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[24] **Report to the President and Congress on Noise,** Environmental Protection Agency, Document No. 92-63, Washington, D.C., February 1972.

[25] **Environmental Quality, The First Annual Report,** Council on Environmental Quality, August 1970, p. 126.

[26] **Report to the President and Congress on Noise,** Environmental Protection Agency, Document No. 92-63, Washington, D.C., February 1972.

[27] **A Guide to the New York City Noise Control Code,** New York City Environmental Protection Administration, 1972.

[28] **United States Code,** Title 23, Section 109 (i).

Noise Measurement

Before proceeding to a discussion of noise standards and the testing program undertaken by the West Side Highway Project, it will be helpful to describe the basic unit of noise measurement—**dBA L_{10}**. This unit consists of three parts: **dB**, the abbreviation for decibel; **A**, a weighting scale for the pitch components of noise; and **L_{10}**, which relates to fluctuations of noise. The **decibel (dB)** is the basic unit for noise measurement, similar in use to degrees in measuring temperature. A one decibel change in noise is about the smallest change detectable by the human ear under ideal laboratory conditions. Actually, outside of a laboratory, it takes a change of approximately three decibels to be discerned without the use of instruments. Generally, a change of at least five decibels is required to cause significant change in the noise level in a community. A ten decibel increase is large and is generally regarded as a two-to-one change in loudness, independent of the initial noise level. In other words, a jump from 40 to 50 decibels will sound like doubling the loudness, as will a jump from 70 to 80 decibels. This peculiarity of the ear's operation is well documented and is important to remember. It provides a guideline to *changes* in the noise level.

The absolute loudness of any noise cannot be expressed in decibels alone. Some additional information is needed regarding the noise character, or pitch components. For example, the exhaust noise from a large diesel truck is low in pitch—a "rumbling" noise. This is very different from the "hissing" tire noise which is high in pitch. Since the ear has different sensitivities to sounds of different pitches, loudness of a particular sound depends upon its pitch components. The **letter A** in the noise unit indicates the manner in which this pitch character of the noise is incorporated to determine the loudness. The A-weighting severely deemphasizes both very low-pitched and very high-pitched components of the total noise, just as the human ear does. For this reason, noise measured in dBA correlates well with subjective personal impressions of loudness and annoyance. Several common noise levels in dBA are shown in Table 19. In practice, the dBA value of a noise is measured directly with a sound level meter, with the weighting switch set on "A".

The third part of the noise unit, the **L_{10}**, concerns noise fluctuations. The noise level in dBA from any highway fluctuates from moment to moment as the traffic passes. The noise level is loudest when the vehicles are closest. It has become standard practice to account for these fluctuations statistically. Various statistical values of this fluctuating level are available for use, including the average noise level, the peak noise level and the noise level which is exceeded only a certain percentage of the time. Guided by the recent noise standards of the Federal Highway Administration, the noise level exceeded for ten percent of the time was chosen for use in this study; this is abbreviated as L_{10}.

The L_{10} part of the noise unit is needed to describe traffic noise, since it is by nature continually fluctuating. As an example, a measured noise level of 80 dBA L_{10} would mean that during the measurement period the noise was below 80 dBA for 90 percent of the time and exceeded 80 dBA for ten percent of the time. The noise sources shown on the left side of Table 19 are fluctuating noises, measured in dBA L_{10}. Those on the right side do not fluctuate, and for these noises the unit is simply dBA.

Table 19 **Typical Noise Levels**

dBA L_{10}	Fluctuating Noises	dBA	Non-Fluctuating Noises
120	Rock Band	120	
110		110	Jet Aircraft at 1000 feet
100		100	Inside Subway Train (New York City)
90		90	Full Throttle Diesel Truck (good muffler)
	Noisy Urban Daytime		Freeway Diesel Truck at 50 feet, 60 mph
80	Shouting at 3 feet	80	
70	Exterior FHWA Standard	70	Auto at 50 feet, 60 mph
	Normal Speech at 3 feet		Vacuum Cleaner at 3 feet
60	Quiet Urban Daytime	60	Auto at 50 feet, 30 mph
	Interior FHWA Standard		
50	Quiet Urban Nighttime	50	Dishwasher (next room)
40		40	Library Background
	Quiet Rural Nighttime		
30		30	Quiet Bedroom at Night
			Concert Hall Background
20		20	
			Broadcasting Studio
10		10	
			Threshold of Hearing
0		0	

Highway Noise Control

Highway traffic is composed of individual vehicles. As these vehicles pass the observer, the separate noises from the individual vehicles combine into total traffic noise. The noise generated by each vehicle depends mainly upon its type and size, its speed and its distance from the listener. The number of vehicles passing per hour is often high enough to cause excessive noise even if individual vehicles generate low levels of noise. Several ongoing federal and state research programs are aimed at reducing vehicular noise generation as low as is technically feasible. Moreover, recently proposed noise standards of the United States Environmental Protection Agency would reduce source noise significantly over the next several years, especially for heavy trucks traveling at slow speeds. But there is a limit to what is technically feasible, and even with quieter vehicles, excessive noise along busy city streets and highways may continue to be a problem because of large traffic volumes and the small distances between the passing traffic and the persons living or working nearby.

"The highway-related noise problem is very complex, and there are no quick or simple solutions. Complete elimination of this nuisance may continue to elude us for a long time to come. Even so, substantial noise reductions are possible, though they will require coordinated efforts from a variety of directions. A three-part approach is needed to achieve the maximum benefit from the control of highway-generated noise: (1) reduction of sound at the source (the motor vehicle); (2) control of the use of land in the vicinity of highways, and, (3) noise abatement measures in the planning and design of highway projects."[29]

Some steps already have been taken in reducing vehicle noise. For example, the dominant traffic noise source on the Lower West Side of Manhattan is the truck. Very significant noise reduction is expected for diesel trucks traveling at slow speeds within the next decade. A 17 dBA drop in noise output for diesel trucks (from 89 to 72 dBA) has already been demonstrated as technically and economically feasible. Such a reduction corresponds to lowering the loudness by two-thirds.

The noise of trucks and automobiles operating at high speeds is dominated by tire hiss, and the outlook for reducing this source of noise is not so bright. The technical problems of reducing tire hiss are not yet solved, and the noise generating factors are not yet fully understood. It is unlikely that more than a 5 dBA reduction is achievable over the next decade. As a result, noise from vehicles traveling at high speeds on open highways will tend to dominate more and more in urban areas as the slow-speed truck noise is reduced, while tire noise from high-speed vehicles is not significantly reduced.

Federal Requirements

The West Side Highway Project, like other Federally funded highway studies, is governed by the laws established by Congress and the implementation procedures for those laws which are promulgated by the Federal Highway Administration (FHWA). In response to legislation, FHWA has developed noise standards for highway design in its Policy and Procedure Memorandum 90-2. The Congress has instructed FHWA not to approve plans for any proposed project on the Federal-aid highway system unless those plans and specifications include adequate measures to implement these noise standards. The regulations allow for the granting of exceptions to the standards for specific areas of a highway under study, if other social, environmental and economic effects indicate that the exceptions are desirable and in the best public interest.

These standards provide that the noise for the loudest hour of the day, after the highway has reached the traffic load for which it was designed, should not exceed the appropriate "Design Noise Level." The Design Noise Levels are based on the sensitivities of specific types of land use, as shown in Table 20. As an example, the residential land use adjacent to the existing West Side Highway falls into categories "B" and "E." For category B, the *exterior* noise level should be less than 70 dBA L_{10} during the loudest hour of the "design year," which is 1995 for this Project. For category E, the *interior* noise level should be less than 55 dBA L_{10}.

Interior noise levels are governed largely by the protection which the building structure provides. Therefore, in order to translate the interior 55 dBA L_{10} standard to an equivalent exterior level, this protection must be estimated. FHWA provides a recommended list of such noise reductions—outdoor to indoor—in lieu of actual measurements. For any structure with open windows, FHWA estimates the noise reduction at 10 dB. Therefore, for open-window buildings, the 55 dBA L_{10} interior limit translates to a 65 dBA L_{10} exterior limit. For the West Side Highway Project, this dual-standard of 65/70 dBA L_{10} has been adopted for residential areas.

Project Noise Measurement Program

The Federal Highway Administration requires a noise study for Federally-aided projects which have not received location approval prior to July 1, 1972, or design approval prior to July 1, 1974. Therefore, the West Side Highway Project has undertaken a study to measure existing highway and traffic-related noise levels, and to predict 1995 noise levels for each of its alternative proposals. The noise levels predicted for each alternative are important ingredients in assessing their relative environmental impacts. The evaluation and comparison of impacts are detailed in Section 4 of this report.

In addition to setting standards for noise levels in the design year, FHWA requires that future noise be compared with existing noise in order to determine if there is an increase, and if the increase is significant. For this reason, an extensive measurement program was undertaken.

For purposes of the noise level studies, both a "primary" and a "secondary" impact area were delineated, as shown in Illustration 21. The primary impact area is defined as the region expected to be affected directly by noise from the highway facility in each alternative. The secondary impact area is that area which would be affected by changes in local traffic due to the provision of a new or reconstructed highway facility.

Considerable thought was given to the selection of measurement sites, which are also shown in Illustration 21, since within any urban neighborhood noise levels may vary considerably from place to place. Due to the number of structures and their particular qualities in terms of shielding or reflecting noise, a very slight shift in the measurement position can result in a large change in noise level. One accepted practice in choosing measurement sites is to select a location which typifies each neighborhood, and then to measure at the location within the site where noise is most severe. The West Side Highway Project testing program has followed this practice in choosing its measurement sites.

The noise measurement program is designed to measure noise related to highway and local traffic sources. If, during the process of measuring, noise from a non-traffic source dominated, the measurements were either repeated when the source was not present, another site was chosen to replace the original site, or the results were considered invalid and were not used as part of the noise data. As an example, the noise at two secondary area sites was continually dominated by noise from a nearby subway line. These measurements were not included in the data used to determine existing conditions or as inputs to predict future traffic-related noise.

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[29] **Noise Standards and Procedures; Final Environmental Impact Statement,** FHWA-EIS-72-02-F, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C., November 1972.

Table 20 Federal Highway Administration Noise Standards

Land Use Category	Design Noise Level (L_{10})	Description of Land Use Category
A	60 dBA (Exterior)	Tracts of land in which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purposes. Such areas could include amphitheaters, particular parks or portions of parks, or open spaces which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	70 dBA (Exterior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas, and parks.
C	75 dBA (Exterior)	Developed lands, properties or activities not included in categories A and B above.
D		Undeveloped lands.
E	55 dBA (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

Primary Area Measurement Sites The major thrust of the primary-area measurements was to document the noise associated with the existing Highway and adjacent West Street/Twelfth Avenue at specific noise-sensitive sites. In general, noise was measured simultaneously at two locations for each site—either at the curbside and the building facade, or at the curbside and the roof. The different elevations for the microphones are important in obtaining a realistic reading of the noise levels. The noise at lower levels will be dominated by the source closest to the microphone—for example, cars and trucks passing on West Street. The higher positions will read not only this noise, but also the noise levels from the highway itself, some of which would be shielded from the lower microphones.

The different microphone elevations are important for another reason. The curbside noise corresponds to noise heard by passers-by. Facade and roof measurements are taken just outside the building, and indicate noise levels which would affect those living or working inside. Factors which approximate the protection provided by the building structure are applied to these noise levels to determine indoor noise.

Each site was measured for three 45-minute periods—during the peak hour for morning traffic (8:00 to 9:00 AM), during a midday hour (9:00 AM to 4:00 PM), and during the afternoon traffic peak hour (4:00 to 6:00 PM).

At the primary site located at the Westbeth housing complex, noise was measured over a 24-hour period. This site was chosen for extensive measurement because it is the largest existing residential complex adjacent to the West Side Highway.

Secondary Area Measurement Sites The major purpose of the secondary area measurements was to establish the general noise climate throughout the area. Since the number of noise-sensitive locations in the secondary impact area is so large, this measurement program was designed to include as many sites as possible. These sites were chosen by the statistically accepted process of random selection. This type of process minimizes the possibility of getting biased results and allows more accurate generalizations to be made about the entire area.

All of the sites selected were on a "noise-sensitive block"—one which contains either residences or any of the noise sensitive sites listed in the City Planning Commission's **Plan for New York City**, such as churches, hospitals, schools, public institutions, landmarks, hotels and parks. From among these noise-sensitive blocks, 58 measurement blocks were randomly selected.

Within a block, the measurement positions were selected within 100 feet of an intersection, so that the data would represent acceleration noise from vehicles. If there were conditions prevailing at the site in which non-traffic noise sources, such as subway noise or noise from construction or demolition produced levels dominant over the traffic noise, the site was eliminated and another site chosen to replace it.

The sites represent a diverse mixture of different traffic situations, ranging from streets with low auto traffic to very highly traveled truck routes. The sites also encompass enough different types of land use and traffic situations so that the noise at a location not specifically measured can be estimated. Nine sites within the 58 noise-sensitive blocks were identified by the Project as particularly susceptible to noise. These sites were considered non-random, and were not included in generalizations concerning the secondary area noise. The noise at each of these sites, both random and non-random, was measured simultaneously at curbside and at the building facade. Each site was measured for one 15-minute period during a summer weekday. The measurements were made uniformly as nearly as practicable over the periods 8:00 AM to 5:00 PM, and 10:00 PM to 11:00 PM.

Other Sites In addition to these sites in the secondary impact area, six sites were chosen for detailed measurement because of their high sensitivity to noise. Of these six, three were drawn from a list of all churches, hospitals, and schools located on truck routes. The largest of each was chosen for measurement, that is, the hospital with the largest number of beds, the school with the most students.

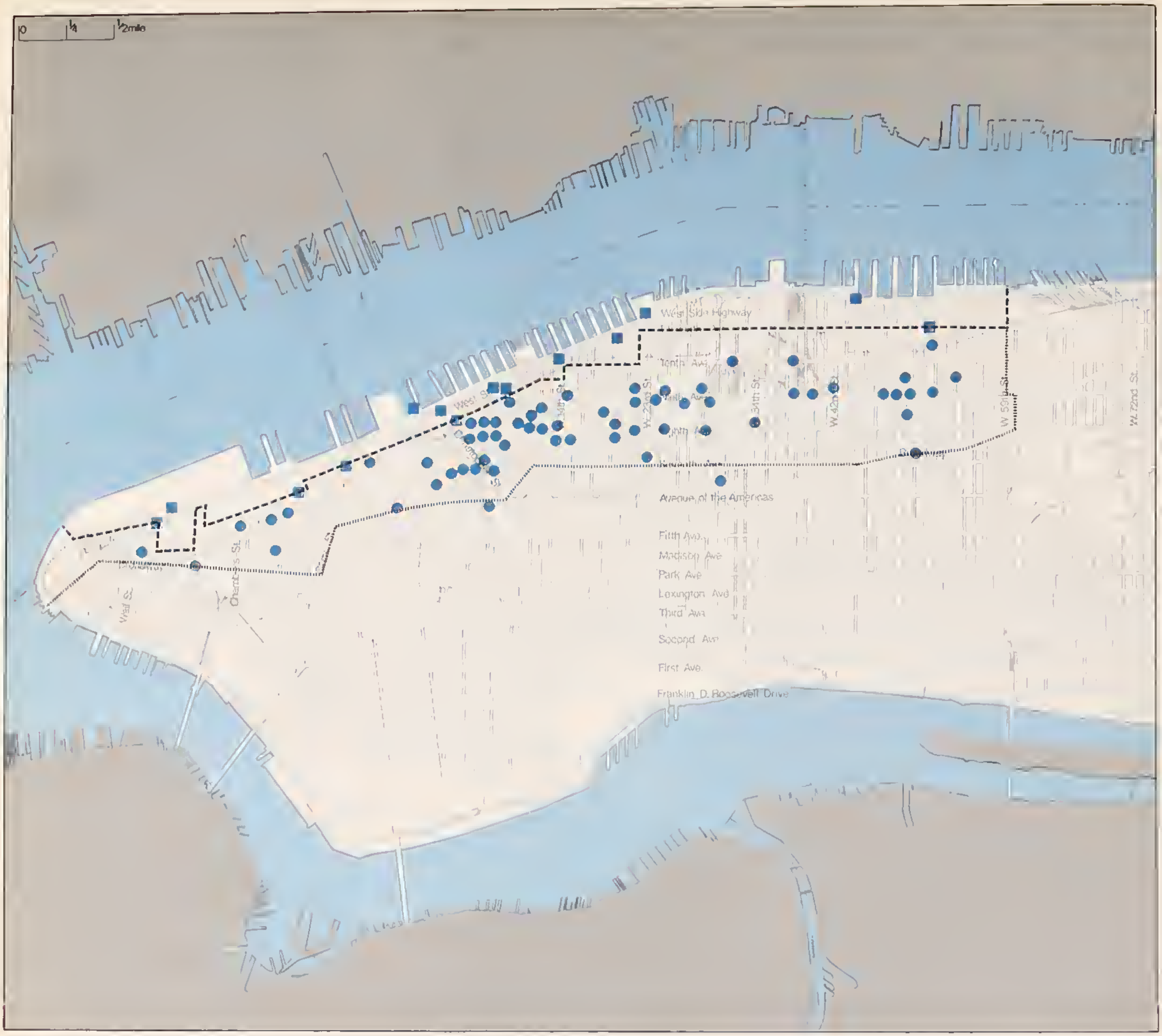

0
1/4
1/2 mile
West Side Highway
Tenth Ave
Ninth Ave
Eighth Ave
Broadway
Avenue of the Americas
Fifth Ave
Madison Ave
Park Ave
Lexington Ave
Third Ave
Second Ave
First Ave
Franklin D. Roosevelt Drive
West St
W 14th St
W 23rd St
W 34th St
W 42nd St
W 59th St
W 72nd St
Chambers St
West St

Illustration 21 Noise Conditions Study Impact Areas and Measurement Sites

■ Primary Site

● Secondary Site

- - - - - Limits of Primary Impact Area

········· Limits of Secondary Impact Area

North

Three other sites were selected in residential areas—two in Greenwich Village and one in Chelsea. In general, each detailed site was measured simultaneously at two locations, either curbside and the building facade, or curbside and the roof. Each site was measured for three 45-minute periods—during the early morning (6:30 to 7:30 AM), during the morning traffic peak (8:00 AM to 9:00 AM), and during the late evening (10:00 PM to Midnight), all on a summer weekday.

Existing Noise Conditions

The **primary impact area** measurements show that the FHWA standard for residential land use of 65/70 dBA L_{10} is exceeded at almost all of the measurement sites. 99 percent of the measurements at the fourteen sites exceeded 65 dBA L_{10} and 89 percent exceeded 70 dBA L_{10}. This includes roof and building facade measurements, as well as those made at the curbside, although roof and facade measurements were generally slightly lower than those made at the curb. (See Table 21.)

The highest curbside measurement in the primary area was at Canal Street between Washington and Greenwich Streets, where the reading was 84 dBA L_{10} during the morning rush hour. This area is generally one of light industrial and commercial land uses, although there are scattered residences in tenement buildings, and it is characterized by heavy traffic volumes and numerous trucks.

As noted previously, the Westbeth Housing site was chosen for extensive measurement because of its proximity to the West Side Highway and because it is a residential complex. Noise was measured for varying periods of time during each hour of a 24-hour day. The measurements show that the curbside noise exceeded 70 dBA L_{10} throughout the 24-hour period; the highest curbside noise reading during this period was 82 taken at 1:00 PM. The roof noise exceeded the 70 dBA L_{10} standard only from 8:00 AM to 6:00 PM, the heaviest traffic period. The maximum roof measurement was 72 dBA L_{10} during the period from 9:40 to 10:25 AM. The Westbeth roof measurements exceeded the lower part of the FHWA dual standard, that is 65 dBA L_{10}, during all measurement periods except one—from 3:50 AM to 4:35 AM, when the reading was 64.5

Noise History at Westbeth Housing Site

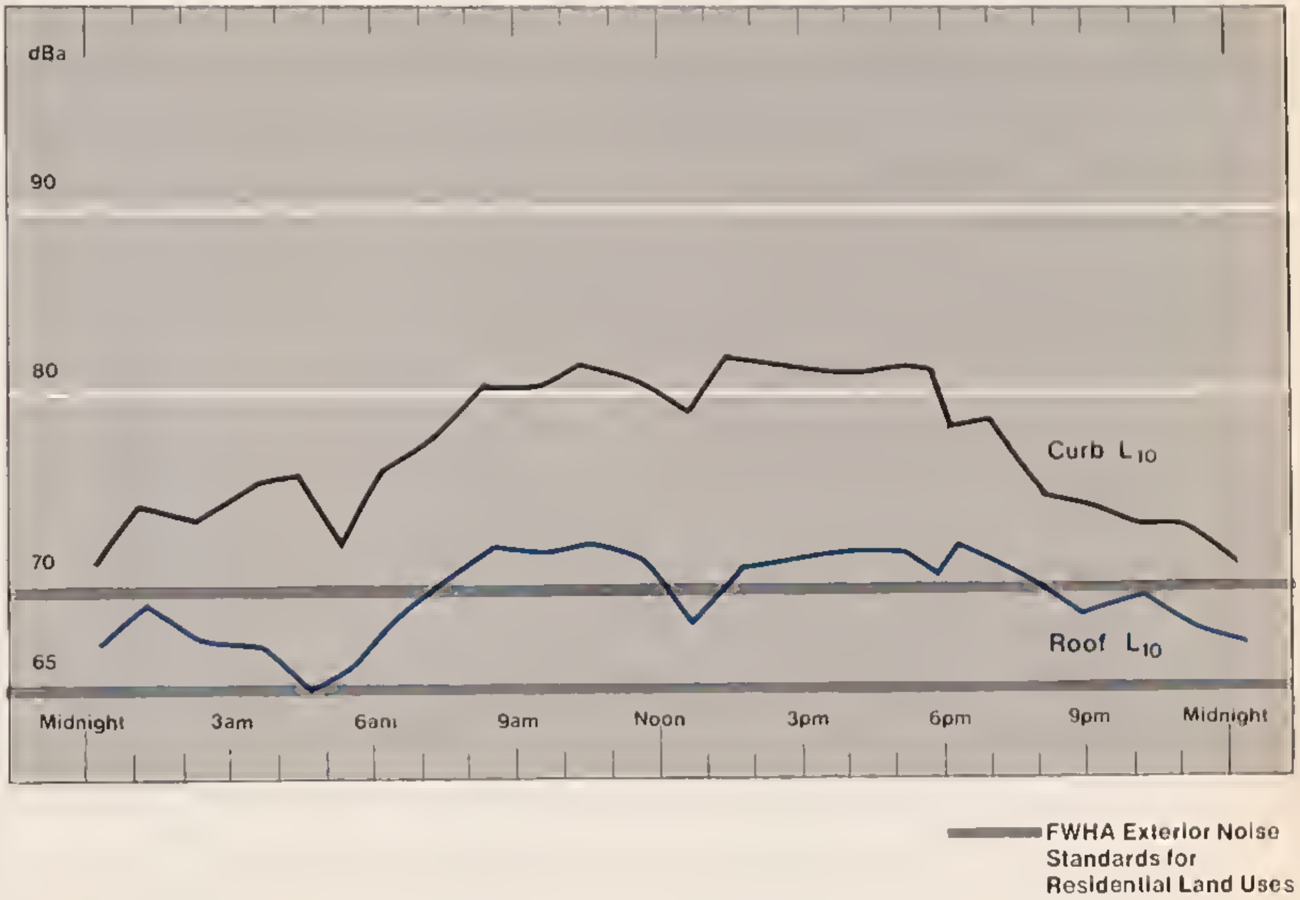


Table 21 **Summary of Noise Measurements in Primary Impact Area**
Measurements in dBAL$_{10}$

Measurement Site	Curbside		Roof and Facade	
	High	Low	High	Low
From Brooklyn-Battery Tunnel to Canal St.				
1 West St. between Cedar and Liberty	80 (Midday)	78 (AM)	78 (Midday)	74 (AM)
2 West St. at Pier 13	71 (AM)	70 (Midday)	66 (AM) (a)	65 (Midday) (a)
3 Greenwich St. between Hubert and Beach	75 (Midday)	72 (PM)	71 (Midday)	70 (AM)
4 Canal St. between Washington and Greenwich	84 (AM)	78 (PM)	82 (Midday)	78 (PM)
From Canal St. to 14th Street				
5 West St. at Pier 42 (Morton Street Pier)	75 (AM)	69 (PM)	68 (PM) (a)	66 (AM) (a)
6 West St. between Christopher and Barrow	82 (AM)	82 (PM & Midday)	82 (PM)	81 (Midday)
7 Washington St. between Christopher and W. 10th	77 (Midday)	75 (AM)	76 (Midday)	75 (PM)
8 Westbeth Housing—on West St. between Bank and Bethune	82 (AM)	81 (PM)	76 (Midday)	75 (AM & PM)
9 Westbeth Housing—on Bethune St. between West and Washington	73 (Midday)	72 (AM)	68 (Midday)	68 (AM & PM)
10 West St. between 13th and 14th	79 (AM)	76 (PM)	78 (AM)	75 (Midday)
From 14th St. to 52nd Street				
11 West St. between 19th and 20th St.	79 (AM)	77 (Midday)	No Measurements	
12 23rd St. between 10th and 11th Avenues	81 (AM)	79 (PM)	79 (Midday)	76 (PM)
13 West St. between 42nd and 43rd Sts.	77 (AM)	73 (PM)	75 (Midday)	71 (PM)
14 11th Ave. between 51st and 52nd Sts.	81 (Midday)	78 (PM)	79 (Midday)	74 (PM)

(a) These measurements were taken at mid-pier. Pier 13 has since been removed and replaced by landfill for Battery Park City.

Also of importance with respect to the results of the Westbeth measurements are the variations in noise levels at different times of the day. Levels at the housing complex showed only a 4 dBA variation, both at the curbside and the roof, during the ten hour period from 8:00 AM to 6:PM. This variation is quite small. During the early morning and evening hours, the noise levels were lower by about 5 dBA, both at curbside (West Street noise) and at the roof (West Street and West Side Highway noise). During the quietest period, the late evening and early morning hours, the West Street noise dropped another 5 dBA. This means that the subjective loudness at the quietest period was about half that at the peak period. It is expected that these same relationships with respect to noise levels at various times of the day are typical of many sites bordering West Street, although the actual noise levels may vary considerably.

Also of particular interest are the measurements at the Morton Street Pier (Pier 42), a recreational facility. Noise levels were measured at the gate adjacent to West Street and at the gangplank of the maritime school ship, or about halfway down the pier. The highest level measured at the gate was 75 dBA L_{10}, taken during the morning rush hour. The lowest gate measurement was 69 dBA L_{10} during the evening rush hour, which is just below the FHWA standard for recreational areas of this type. The highest level measured at the school ship gangplank was 68 dBA L_{10}; the lower noise level at the gangplank reflects the increased distance from the source of the noise on West Street.

In the Chelsea area, the primary site at 23rd Street between Tenth and Eleventh Avenues showed readings ranging from a high of 81 dBA L_{10} at curbside during the morning rush hour, to a low of 76 dBA L_{10} at the building facade during the evening rush hour. These readings are considerably in excess of the FHWA standards for residences.

Measurements in the Midtown area at a residential site between 51st and 52nd Streets on Eleventh Avenue were also considerably above the standard. The high reading at that site was 81 dBA L_{10} at midday, the low reading 74 dBA L_{10} during the evening rush hour.

Measurements for the six **secondary impact area** sites representing particularly sensitive activities were taken during the early morning from 6:30 to 7:30 AM, during the morning rush between 7:30 and 9:30 AM, and in the late evening from 10:30 PM to Midnight. Noise was measured at each site for 45-minute periods during at least two of the three periods of the day. The highest level was at a residential site in Chelsea, the measurement was 82 dBA L_{10} in the early morning period, and was taken at the building facade. The lowest reading among the sites was 65 dBA L_{10} on Hudson Street in the West Village. The measurement was taken at the building facade during the late evening. Only six of the 33 measurements at these sites were below 70 dBA L_{10}.

Among the nine sites identified by the Project as sensitive, measured noise levels ranged from 71 to 81 dBA L_{10} at curbside, and from 70 to 80 dBA L_{10} at the building facades. Six of the nine curbside measurements were between 78 and 81 dBA L_{10}. Four of the seven facade measurements taken at these sites were above 77 dBA L_{10}.

For the secondary area sites which were randomly selected and which can be used to make generalizations about the area as a whole, all measurements were above the 70 dBA L_{10} standard, both at curbside and at the building facades. The highest level recorded was 81 dBA L_{10}; the lowest level was 71 dBA L_{10}. The detailed results of the measurement program for both primary and secondary impact areas are contained in the Project's technical reports on the noise study.

Summary

The results of the measurement program undertaken by the West Side Highway Project indicate that traffic noise in both the primary and secondary impact areas exceeds the Federal Highway Administration standards on a broad scale at the present time. Both the curbside noise levels, which would be heard by passers-by, and the roof and facade noise levels, which would affect those living and working in the buildings, are generally in excess of the dual standard of 65/70 dBA.

The primary area measurements also indicate that there is little variation in noise levels measured at different times between 7:30 AM and 6:30 PM. The average difference between the highest and lowest measurements was slightly less than 3 dBA for curbside noise. (See Table 21.) The average difference in roof and facade levels was just over 2 dBA. Thus, with few exceptions, the sites with high noise levels were noisy during the morning rush hour, the midday period, and the evening rush period.

The results of the measurements in the secondary impact area show noise levels in excess of the 70 dBA L_{10} standard at all randomly selected sites. Since these measurements are representative of the area as a whole, it can be assumed that traffic-related noise levels in the secondary area generally exceed both the 65 and 70 dBA L_{10} standards at the present time.

Water Quality

The studies of air quality and noise are easily recognizable as matters of concern in the planning of transportation and land-use alternatives for the West Side. However, the importance of water quality is not as apparent at first glance. In fact, the water quality of the Hudson, especially in the Study Corridor area, is important to both of the major planning aspects of the Project—transportation alternatives and land-use alternatives.

Among the major considerations which go into planning alternative land uses in a waterfront area, the quality of the water is of prime importance. Certain types of land uses and the activities associated with them are very sensitive to the condition of the neighboring water. Beaches and waterfront parks are the most obvious, the first requiring very clean water and the second able to function with somewhat lesser water quality, since swimming and other activities which may involve swallowing water are not an essential part of their function. Housing in a waterfront area is also sensitive to water quality, particularly to the odors of water that routinely has surface deposits of oil or gasoline, or which is used for dumping of raw sewage. Therefore, for the planning of alternative land uses along the West Side waterfront, it is essential to determine the present and the projected future water quality of the Hudson.

The consideration of water quality in the planning of transportation alternatives is less obvious. The Hudson River in the impact area carries large amounts of silt and other waste matter. Where the River flows along a relatively smooth shoreline, there is only a minimal buildup of these materials. However, where there are interruptions in the shoreline, such as piers or pilings supporting other structures, the flow is partially interrupted and large amounts of silt settle out. Under the older West Side piers, so much silt has built up that there is virtually no flow of water. To further complicate the problem, deposits of oil and gasoline wash in from the main River channel and remain on the surface in the basins. Within the study area, 23 sewer outfalls pour untreated "raw" sewage from the West Side of Manhattan directly into the pier basins along the West Side waterfront. These conditions have important implications in planning the location and the construction techniques of highway and transit alternatives for the area.

Any alternative which would involve construction in the River would obviously have a greater effect on water quality than one confined to the existing land area. Given the problems with siltation in the Hudson, and the consequent undesirable effects of construction on pilings in the River, it is important to consider construction of a type that would not serve to create coves or inlets along the shoreline. Consideration of highway and transit alternatives which would serve to smooth the shoreline and improve the flow of water is, therefore, an important factor.

Because of the buildup of silt and settled sewage in the pier basins, it is also important to consider construction techniques which would disturb as little of this material as possible in order to avoid contaminating the main River channel.

These kinds of considerations, coupled with the land-use considerations discussed above, make a thorough study of water quality necessary in determining the environmental impact of the West Side Highway Project alternatives.

There are two major aspects which must be considered in determining the water quality of a river. The first deals with the river's physical characteristics. These include a range of factors which define the stream, such as its mix of seawater and freshwater, its location and its flow characteristics, as well as many others. The second involves the actual measurement of the quality of the water by various parameters in a sample testing program. A more detailed discussion of the materials in this section are contained in the technical reports of the West Side Highway Project water quality studies.

Physical Characteristics of the Hudson

The Hudson River has its source in the Adirondack Mountains in northern New York State. The River flows south to its mouth at the southern tip of Manhattan where its waters join those of Upper New York Bay. For about half of its 315-mile length, the Hudson is a tidal estuary; that is, there is a mix of freshwater flow from the north and the tidal flow of seawater entering from the ocean through New York Bay. The Federal Dam at Troy, New York, about 154 miles from the River's mouth, provides a barrier against the tidal effects advancing further upstream, and thus creates a man-made head for the estuary.

The Main Channel The Hudson River estuary is a relatively deep and straight channel. The surface width varies significantly along the length of the estuary due to the presence of several bays and shoals, or sandbanks, in the Lower Hudson. The widest section of the River is located at Haverstraw Bay, where the surface width reaches almost three miles.

The flow characteristics of the Hudson are of particular importance to water quality, since they determine to a large extent the River's ability to cleanse itself of silt and wastes. Because the Hudson is a relatively deep estuary, the speed, or velocity, of the flow is slower in the lower layer than would be the case in a shallower channel.

The Hudson is classified as a "partially stratified estuary." An estuary is described by the proportion of salt water tidal flow to freshwater flow. When the salt water and fresh water are equally mixed, as in the Delaware River Basin, the estuary is classified as completely mixed. When they are in layers, as in a Norwegian fjord, the estuary is in the completely stratified category.

The Hudson is intermediate between these extremes. In an estuary of this type, the heavier seawater moves upstream in a lower layer beneath the lighter freshwater which is moving downstream. The seawater gradually mixes with the freshwater layer and a chemical reaction occurs between the silt particles being carried downstream and the salt in the seawater. The reaction causes the silt particles to clump together. The River lacks sufficient velocity to carry these clumps of silt along, and so they settle to the bottom and gradually build up. This buildup is known as shoaling, and is a significant problem in the Hudson estuary.

Inshore Area Generally speaking, the factors which influence flow in the main channel also bear heavily on the flow characteristics of the inshore areas. The most obvious difference between the main channel and the inshore area is that the inshore area experiences very little north-south flow. This is because of the existence of the piers and their effect of impeding the flow, and the buildup of silt and waste matter under them.

Therefore, the currents which affect the pier basins are lateral flows caused by tidal action and by the differences in density between the salt water and the fresh water in the main channel. These density induced currents provide a complete exchange of water in the pier basins during each 13-14 hour tidal cycle.

Despite this water exchange, severe silting and waste material settlement occur in the pier basins. This is because the water entering the pier basins is largely the slower moving salt water which carries with it considerable amounts of silt from the main channel. This material settles out on the bottom of the basin and builds up against the pier pilings

Since 1850, raw sewage from New York City has been directly and continuously dumped into the Hudson River. At present, there are 23 combined sewer outfalls within the study area which pour human wastes and storm sewer flow directly into the pier basins. The locations of these sewer outfalls are shown in Illustration 22. Solid human wastes, euphemistically referred to as "settleable solids," are too heavy to be carried out of the basins by the water exchange. The raw sewage and silt sink to the bottom of the basins, forming new layers over the waste material that has been building up alongside Manhattan for more than 120 years.

The deposit of waste matter into the pier basins has one very dubious benefit. The pier basin in this case acts very much like a primary sewage treatment plant, in allowing the settling out of waste matter. Because of this, the water that moves into the main channel is considerably cleaner than would otherwise be the case The major difference is that the waste matter in the pier basins stays there, whereas in a treatment plant, it is pumped out and buried as land fill or subjected to further treatment.

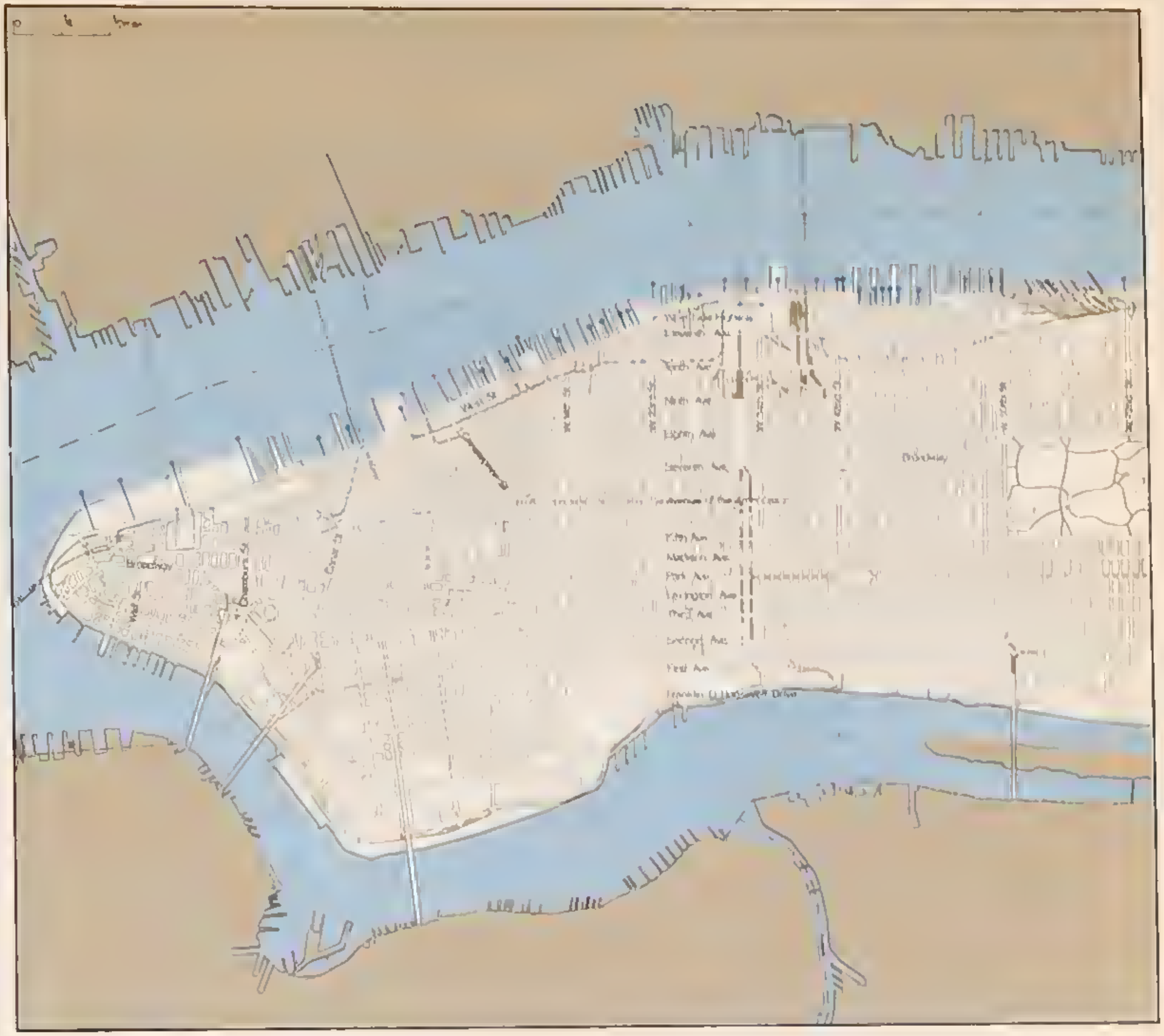


Illustration 22 Sewer Outfalls on the West Side

⟶ Sewer Outfall Location

North

Life in the Lower Hudson The Hudson, like other important Atlantic estuaries, fills the many needs of fish life that the ocean itself cannot provide. Oceanic fish take advantage of such basic characteristics as shallow water, low salinity, and protection from storms, surf and many types of predators, which the estuary provides.

Examples of the needs fulfilled by the Hudson for migratory fish are spawning areas for fish like shad, which do not spawn in the sea, winter protection for species like the striped bass, that cannot survive in the ocean during the coldest months (minimum ocean temperature is about 28 F, while the minimum temperature of the Hudson is about 30 to 32 F, depending on the salinity of the water); and nursery areas for the young of oceanic species, like bluefish, that must find sanctuary in the waters of estuaries to survive their first year of life. Much of the harvesting of these migratory species occurs outside the River. Therefore, the potential of the Hudson is not contained within its physical boundaries, but may extend hundreds of miles along the coast within the migratory ranges of the fish that depend on the River during some stage of their development.

Biological life which spends all of its time in the portion of the Hudson under study in this project is restricted to organisms which can survive under conditions of rapid and extreme fluctuations in both salinity and temperature. Most organisms cannot survive under these conditions.

The major factor in this local environment which affects biological organisms is the variation in salinity which occurs due to both normal seasonal cycles and to freshwater runoff as a result of moderate and severe storm activity. This environment is naturally limited to rather unique resident organisms which can tolerate rapid and severe fluctuations in salinity. Offshore and in deeper water, there is some protection afforded by the massive salt water wedge moving up the River from the Bay, but at the surface and inshore, the fluctuations can be of a violent nature with a change from approximately 70 percent salt water to almost completely fresh water in less than an hour.

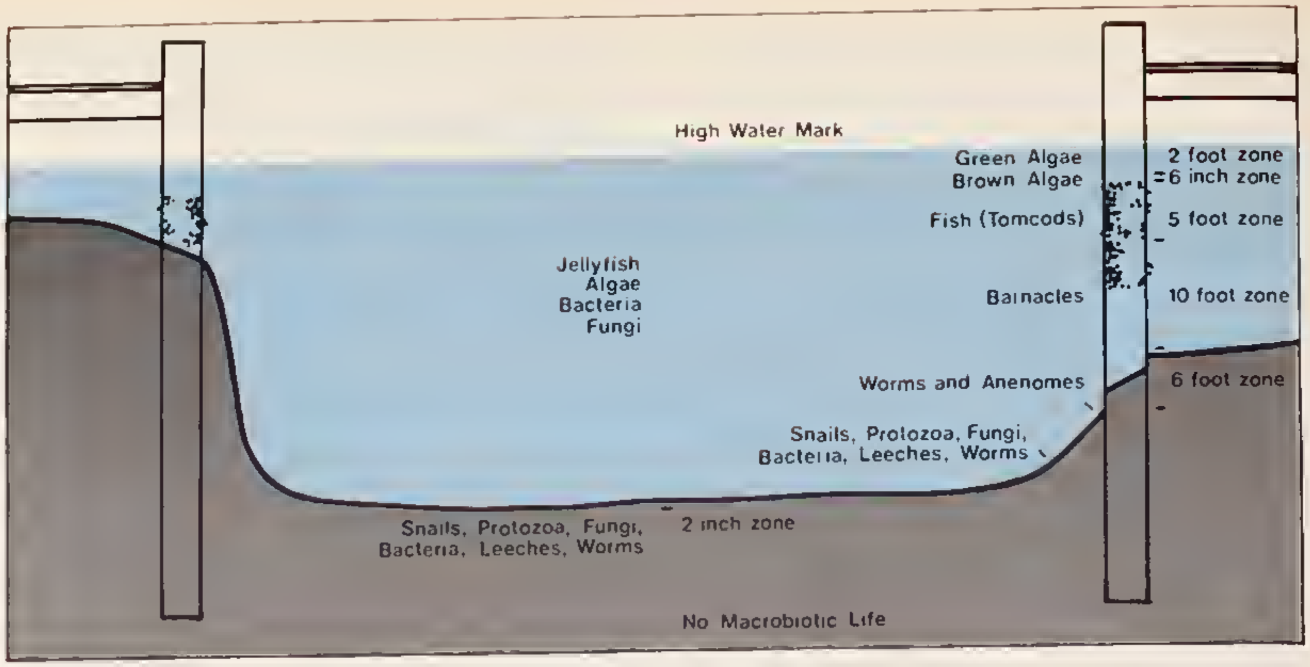


Illustration 23 Life Forms in a Typical Pier Basin on the West Side

In addition to these natural pressures, the water in the study area has also been subjected to severe biological stresses due to the heavy pollution of both human and industrial wastes that have been part of the ecology for several decades.

In general, the inshore area of the Hudson can best be described as a highly unique biological habitat with a resident population of organisms which can tolerate both severe salinity changes and heavy pollution. These organisms consist of a relatively few species of fish and invertebrates, and a large microbiological population associated with decomposition of organic wastes. A schematic representation of the life forms in a typical pier basin is shown in Illustration 23.

Water Quality

There are several basic measures used in determining and expressing the quality of water. The most important of these are measures of its oxygen content. Oxygen is used as a main indicator for two reasons. First, fish and other aquatic life need oxygen to survive. Second, oxygen is a necessary part of the decomposition of organic matter. If excessive amounts of organic matter are present in a stream, their decomposition may seriously reduce or completely use the oxygen dissolved in the water. The following are the measures used in determining the oxygen levels in water.

Dissolved Oxygen This is the oxygen dissolved in water, wastewater or other liquid. It is usually expressed in milligrams per liter, parts per million (ppm), or percent of saturation.

Some species of fish and other aquatic life require more oxygen than others. When the oxygen dissolved in the water of a stream is greatly reduced, lower orders of fish, such as carp and pike, replace the original fish population. The amount of oxygen in a body of water is, therefore, one of the best measures of its ecological health.

The ability of water to hold oxygen is small. At ordinary temperatures in a stream, the water is saturated (can hold no more) by nine parts per million of dissolved oxygen. Most fish require at least two to three parts per million to survive.

Biochemical Oxygen Demand (BOD) Organic wastes decompose by bacterial action. Bacteria attack wastes dumped into rivers, using up oxygen in the process. Organic wastes are measured in units of biochemical oxygen demand which indicates the amount of oxygen needed to decompose them.

This is a standard used in assessing the strength of wastewater. It is the quantity of oxygen used in the decomposition of organic matter in a specified time, at a specified temperature, and under specified conditions. The BOD content is usually expressed in milligrams per liter, parts per million or in pounds.

Five-Day BOD is that part of the oxygen demand associated with the biochemical oxidation of carbon-based material, a first stage of decomposition. It is determined by allowing biochemical oxidation to proceed under specified standard conditions for five days. Five-day BOD is about 75 percent of total BOD.

Since the maximum amount of oxygen dissolved in a stream of water is only from seven to ten parts per million (ppm), a BOD in excess of ten ppm would be intolerable.

If excessive amounts of organic matter, measured as BOD, require all of the oxygen present in water for decomposition, an anaerobic (without air) decomposition process will be set in motion with a different mixture of bacteria. Instead of releasing carbon dioxide in the decomposition process, anaerobic decomposition releases methane and hydrogen sulfide. In such highly polluted situations, the river turns dark, and foul odors penetrate the environment.

Temperature The effect of a temperature rise in the water of a stream is to reduce its capacity to retain dissolved oxygen, and thus has an effect similar to biochemical oxygen demand. Fish will prefer cool water with its greater oxygen content.

Fecal Coliform Level Closely related to the measures of oxygen content and oxygen demand is a measure of the type and number of bacteria present in the stream. Coliform group bacteria are a group of bacteria predominantly inhabiting the intestines of man or animal. Their presence in the Hudson is a result of the dumping of human wastes into the River. The fecal coliform level is the number of coliform bacteria found in a given number of water samples examined under prescribed conditions. Obviously, the presence of any fecal coliform in water is undesirable, but levels above 200 are considered a health hazard if the water is swallowed. The greater the number, the greater the pollution.

Suspended solids are materials which either float on the surface of, or are in suspension in, water, and which can be readily removed by standard filtering procedures. They consist of the sediment in suspension in the stream and very fine soil particles, maintained in suspension by the movement of the water or its currents.

Settleable solids are matter in water which will not stay in suspension during a pre-selected settling period, such as an hour. They either settle to the bottom, or float to the top.

The indicator **pH** describes the acidity or alkalinity of water. Neutral water has a pH value of seven. Values below seven indicate an acid or corrosive water and values above seven indicate alkaline water. The pH is affected by the dissolved mineral matter in the water. Calcium and magnesium carbonates, for example, increase the alkalinity of water ("hard" water is alkaline); chlorides and sulfates of sodium, calcium and magnesium increase the acidity. Fresh sewage is alkaline, while stale sewage becomes acid.

Hudson River Standards
The agency which has responsibility for establishing the Hudson River water quality classifications and standards is the Interstate Sanitation Commission. This body was established under the Tri-State Compact for Pollution Abatement, by the States of New York, New Jersey and Connecticut. The compact recognizes that, where waters are used for such varied purposes as bathing, navigation, shellfish harvesting, the development of fish life and the disposal of wastes, no single standard of purity is practical for all parts of the district.

In order to attain the objectives of the Compact, the Commission has grouped the waters of the Hudson into classes of desirable water quality, which may be changed as local conditions change. The Hudson River waters have been grouped into three classes, according to the desirable water quality and uses of particular areas of the River.

Class A Waters in this class are to be suitable for swimming, surfing and other direct contact recreation which may involve swallowing water. Many parts of the upper Hudson have this classification. Dissolved oxygen for Class A waters is not to be less than 5 ppm. Fecal coliform levels are not to exceed 200 per 100 ml.

Class B-1 Waters are to be suitable for fishing and secondary contact recreation such as boating. These are activities in which the probability of significant contact with or swallowing of water is minimal. Dissolved oxygen levels for B-1 portions of the River are to be at least 4 ppm. Fecal coliform levels are not to exceed 200. Waters of the Hudson in the study area are to meet these requirements for Class B-1.

Class B-2 This classification generally applies in areas where there are no recreational uses of the water or waterfront. They are principally waters used for navigation and waterborne transport. Dissolved oxygen levels are not to be below 3 ppm for these areas.

Planned Sewage Treatment Facilities

On the West Side of Manhattan, sewage presently is discharged into a collection system which transports both storm water from the streets and human wastes from domestic dwellings, commercial buildings and industrial complexes to the Hudson River. Between the Battery and 52nd Street, there are two drainage basins. The first is located between the Holland and the Brooklyn-Battery Tunnels. The second basin is located between the Holland Tunnel and 52nd Street. At present, all of the flow from these basins is discharged into the Hudson.

Two major sewage treatment facilities eventually will treat the flows from these basins. The first is the Newtown Creek Plant. When final construction is completed in 1975, the wastewater flows from the lower drainage basin will be pumped to this plant for treatment. The second facility is the North River Sewage Treatment Plant, now under construction at the edge of Riverside Park between 135th and 145th Streets. The interceptor sewer to serve the North River Plant is scheduled for completion late in 1974. The plant itself is to be completed in 1979.

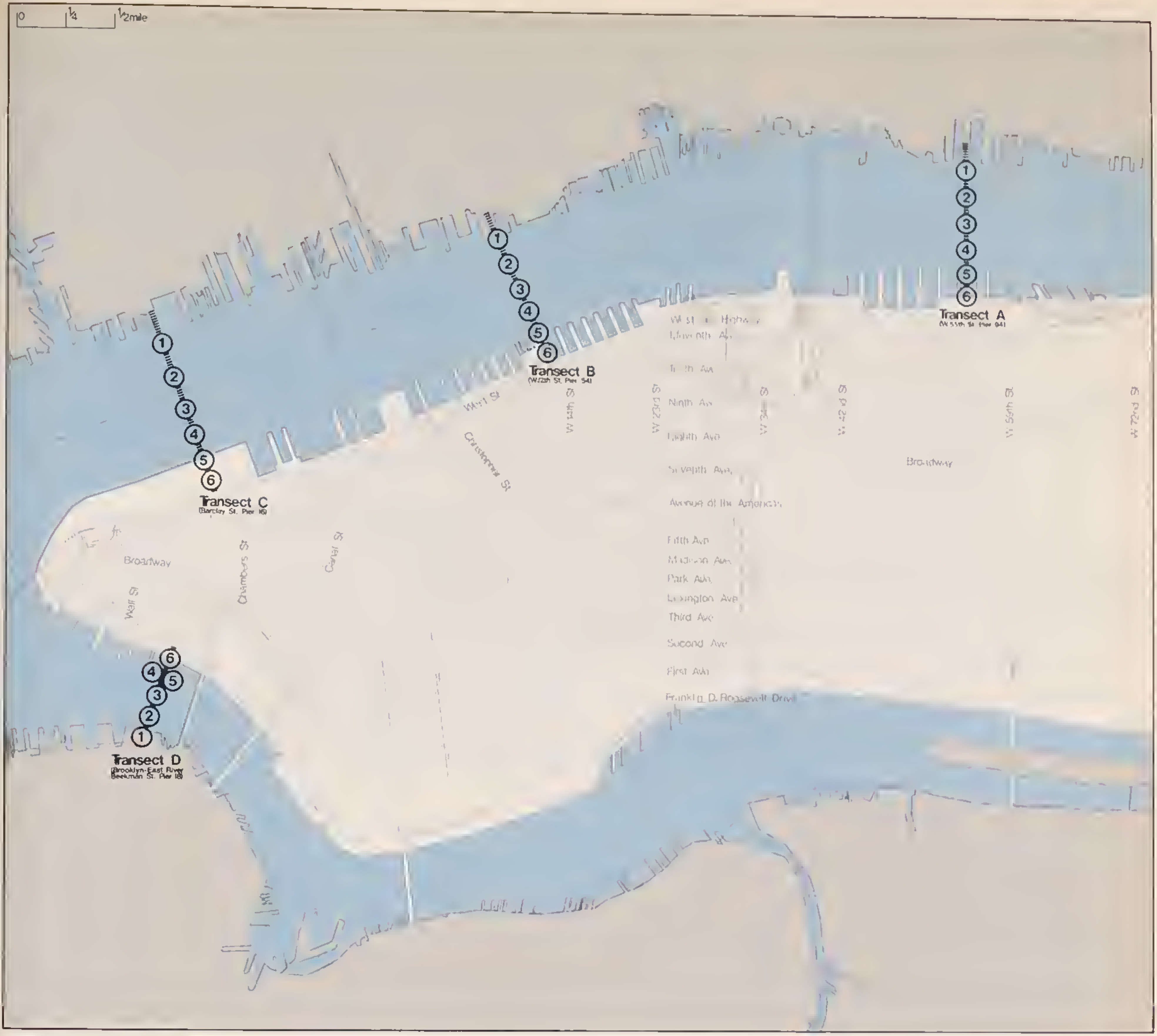
The Project Testing Program

There were two interrelated aims of the water quality study undertaken by the West Side Highway Project. Both were focused on the development, evaluation and comparison of land-use and transportation alternatives for the study area. The first aim was to determine the flow characteristics of the main River channel and the inshore area, such as tidal effects and currents, so that a model could be made for testing the effects of the alternative highway and transit configurations. The second aim was to determine the existing water quality of the Hudson for use as a base in projecting future water quality. Studies of flow characteristics and water quality testing were undertaken for both the main River channel, including areas above and below the Project study area, and for the inshore area which would be most directly affected by the project.

The waters of the main channel of the Hudson River were probed and analyzed in the Project water quality study

Illustration 24 Water Quality Study Transect Locations and Measurement Sites

┼┼┼┼┼┼	Transect Line
○	Measurement Site
↗	North


0
¼
½ mile
Transect A
(W. 55th St. Pier 94)
Transect B
(W.12th St. Pier 54)
Transect C
(Barclay St. Pier 16)
Transect D
(Brooklyn-East River
Beekman St. Pier 18)
1
2
3
4
5
6
West St
Christopher St
W 14th St
W 23rd St
W 34th St
W 42nd St
W 55th St
W 72nd St
Broadway
West Side Highway
Eleventh Ave
Tenth Ave
Ninth Ave
Eighth Ave
Seventh Ave
Avenue of the Americas
Fifth Ave
Madison Ave
Park Ave
Lexington Ave
Third Ave
Second Ave
First Ave
Franklin D. Roosevelt Drive
Broadway
Wall St
Chambers St
Canal St

Main River Channel The major product of the study of the main channel was a model which could be used to project future currents and flow characertistics of the Hudson, and future water quality under different sets of circumstances. These different circumstances would include such factors as construction of a new highway offshore on landfill and the effects this action would have on the flow and the buildup of silt, removal or continued existence of the piers, and the effects of different levels of treatment of sewage and industrial wastes on the water quality of the Hudson.

In order to construct the model, a number of factors were studied. These included the levels and velocities of flows of fresh and salt water, the "density induced currents" caused by the intrusion of salt water into the estuary, settlement of silt and waste matter, tidal effects, channel depth and width, and other lesser factors. The modeling process is described in detail in the water quality study technical report.

Since the water quality of the Hudson in the study area is affected by flow entering from upstream, outside of the study area, use was made of data collected on other areas of the River by the Interstate Sanitation Commission, the Department of Public Works of New York City, and data from a 1967-68 survey for the New York State Department of Environmental Conservation. These data were used in establishing the base conditions of water quality in the main channel.

The water quality of the main channel in the study area must be described as very poor because of the extremely high levels of fecal coliforms. Past studies indicate levels ranging as high as 82,000 in the area between the Battery and the George Washington Bridge, indicating heavy pollution from human wastes poured into the River. Even in upstream areas where coliform counts are relatively low, at 1000, they are five times the standard set by the Interstate Sanitation Commission.

Floating debris is common along the West Side waterfront in the basins between the remaining piers

The other measures of water quality also indicate heavy pollution in the Lower Hudson. Dissolved oxygen, which is relatively high in upper portions of the River, drops off precipitously in the waters of the study area to less than 3.0 ppm at the Battery. Again, this is well below the Sanitation Commission standard of 4.0 ppm for Class B-1 waters. Biochemical oxygen demand levels in the area are high, another indication of the heavy pollution.

The Inshore Area The inshore area test program included field surveys and assessments of the present environment for the area from 52nd Street to the Brooklyn-Battery Tunnel. Because of its interaction with the Hudson, the waters of the East River were also studied.

Tests were conducted at a number of different locations. Biological tests and flow measurements were done at three transect locations on the Hudson, and at one location below the mouth of the East River, as shown in Illustration 24. Samples were taken at various points along each line across the River in order to assure that water quality could be determined for the whole width of the River, and to guard against biased results which might have been obtained if only one point were used.

The major factor which affects the quality of the water in the inshore area is the almost continuous dumping of human wastes from the sewer outfalls, which pour directly into the pier basins. This waste matter, and the silt carried in from the main channel, settle to the bottom of the basins and add to the build-up which has been going on for more than 120 years. Although no coliform counts were done in the inshore area as part of this Project, tests performed for the New York City Environmental Protection Administration in 1973 indicate coliform levels in the Hudson ranging from 23,000 per 100 ml. at 42nd Street, to 110,000 in the vicinity of Battery Park. These levels range between 115 and 550 times the Interstate Sanitation Commission standard of 200 per 100 ml

The buildup of silt under the piers effectively blocks any north-south flow of water, which might otherwise serve to cleanse the inshore area of some of these wastes. The lateral flows which provide the water exchange in the basins are not of sufficient speed or strength to flush out the sewage and silt deposits.

Dissolved oxygen levels of samples taken by the New York City EPA during August 1973 were very low. With water temperatures between 70 and 75 degrees, dissolved oxygen ranged from a high of 5.4 part per million (ppm) to a low of 1.2 ppm, with 13 of 16 samples below 3.0 ppm. These levels are not sufficient to support aquatic life of higher types. The low levels of dissolved oxygen, the rapid changes in salinity and severe pollution from sewage prevent all but the lower forms from residing in the basins. Life forms resident in the inshore area are fish such as carp, and worms, jellyfish and leeches.

The bottom material sampled in the pier basins showed a fine layer of silt, about two to three inches thick, which lies over the layer of sewage solids. The only life forms known to exist in the bottom sewage layer are the bacteria which act in the decomposition of the organic sewage solids.

Observed Conditions

As important as the standard indicators of water quality, such as dissolved oxygen and coliform levels, are the water quality conditions which are apparent to those who work or walk along the waterfront. Fecal matter is discharged into the basins from the numerous sewer outfalls just below the water surface. Being lighter than the salt water in the basins this fecal matter rises to the surface in a "boil," and spreads out over the surface of the basins. These sewage solids remain on the surface of the water for several hours after discharge before settling to the bottom of the basin or being washed out into the main channel.

Planks, timbers, plastic jugs and foam cups, bottles and all sorts of other trash find their way into the basins. Winds from the west tend to hold floating materials back near the bulkheads. Oil collects in the basins, and most of the floating debris is coated with this thick, black oil. Boats venturing into the basins end up with a black ring around their water line.

Sunken barges and loose timbers and piles from dilapidated piers float on or near the surface of the water. During some tide periods, they are submerged and invisible, and present a real hazard to small pleasure craft venturing into the basins.

Along the Manhattan shore of the Hudson, direct water contact recreation is both unappealing and illegal. New York City ordinances prohibit swimming in the River because of the frequent nearby sewage outfalls. While mere contact with the water would be hazardous for a person, swallowing some of it would cause serious medical consequences.

Walking or sitting near the water edge is, of course, not prohibited, although there are few places within the Study Corridor where recreational access to the water is possible at the present time. When the water is quiet, the polluted conditions are not readily apparent. However, when the sewage solids on the bottoms of the basins are stirred up, as by ships' propellers, a cloud of black sediment is visible. The hydrogen sulfide gas released is responsible for the foul odors reported by dock workers and passengers when tugs docking large vessels stir up a mixture of sewage and mud.

In summary, those portions of the Hudson River bordering the Project area today do not offer attractive water quality to the adjacent areas of the West Side.

Transportation and Travel

American society today is a society in motion. Here, people regularly change their places of working, living, shopping and relaxing, as well as continually moving from one area of activity to another. This contemporary mobile society creates the demand for a transportation system capable of responding to the needs of such a dynamic life style.

In the New York Region, the streets and subways, bridges and tunnels, stations and garages, and the cars, trains, trucks and buses comprise a complex transportation system that supports the variety of life styles of the nation's largest urban concentration. In the decade between 1960 and 1970, there were many significant changes in the transportation system and travel patterns of the New York metropolitan area. This section discusses those changes, and the Project's forecasts for the design year of 1995. More detailed explanation of the work presented in this section is available in the technical reports on the transportation and travel studies of the Project.

Many of these changes in transportation and travel can be understood in terms of the residential and employment shifts taking place within the New York Region. The Tri-State Regional Planning Commission defines the Region as consisting of three sub-areas—Core, Inner Suburbs and Outer Suburbs. The overwhelming share of the Region's population growth between 1960 and 1970 took place in the Outer and Inner Suburbs, while the Core grew only slightly. While the Outer Suburbs increased by nearly 1.3 million residents, and the Inner Suburbs increased by 559,000, the Core had only 38,000 more people in 1970 than in 1960. In addition, all of the growth in the regional resident labor force for that decade was in the Outer and Inner Suburbs, which rose by 542,000, and 319,000, respectively, while the Core lost 156,000 resident workers.

Accompanying these significant demographic changes is the fact that people in the New York Region relied more heavily on the automobile to get to and from work in 1970 than in 1960. There were both relative and absolute increases in auto travel and decreases in public transit patronage during the decade, particularly in those areas not well served by transit. For the Region, there was an increase of more than 1.1 million auto driver and passenger journeys to work daily, and a decrease in subway, bus and railroad journeys to work of 319,000 daily.[30]

The growth in the suburbs can be attributed to the availability of large amounts of relatively cheap land, and the provision of public services necessary to support housing, industrial and office park development, such as water, sewers, roads and schools. When people choose a location for their homes or businesses, they explicitly or implicitly weigh many factors. One major factor in this trade-off is the cost of travel, whether in terms of out-of-pocket expenses, time or inconvenience. For the businessman, travel costs result from shipping and receiving goods, and the availability of a work force reasonably close to the job site. The resident pays to travel to work and back, and to shops, schools and parks.

Between 1960 and 1970, many people and businesses found that they could buy more space for their money in the suburbs around New York than they could in the City. Other factors, such as schools, open space, quiet, safety and less congestion, were perceived by many as attractive features of suburban living. As more members of the labor force opted for homes in the suburbs, it became increasingly attractive for many firms to locate outside of the City. Thus, many new office and industrial buildings were built in areas which had formerly been considered unacceptable for such uses.

Although on a relative basis there is much greater reliance on the auto for journey-to-work trips in the suburbs, auto usage to go to work has increased throughout the Region. In the Core, the percentage of workers using the auto for their journey to work increased from 24.3 to 30.3 percent between 1960 and 1970. This happened despite only a slight growth in auto ownership in the Core. In the Inner Suburbs, the share of journey to work trips using auto rose from 68.4 to 76.7 percent, while in the Outer Suburbs it grew from 85.4 to 89.9 percent.[31]

While the City resident has at his or her disposal an extensive array of public subway, bus and taxi services, the suburban dweller has a much more restricted choice of transport mode. While mass transit services are available in the suburbs, their attractiveness relative to the automobile in terms of time, cost and convenience is not sufficient to attract very large ridership.

Another factor affecting transit ridership is that much of the recent suburban growth has been in between the radial transit corridors emanating from Manhattan. Circumferential transit service that could connect these suburban areas with the radial spokes has not kept pace with the new growth. Thus, even if people who live in these areas want to use transit, they have to make part of their trip by automobile. Hence, because of the disparity in relative attractiveness, a person residing in almost any suburban county and working in the Manhattan Central Business District was more apt to come to work by car in 1970 than in 1960. (See Table 22.) The same was true for the Manhattan resident making the reverse commute to a job in Suffolk County on Long Island.

The purpose of this section of the Environmental Impact Statement is to communicate an understanding of the present state of the New York area transport system, which is focused on the Manhattan Central Business District (CBD), based on what has happened during the past ten or twelve years, and to forecast the likely situation in 1995. Particular emphasis is placed on describing the present and future role of the West Side Highway as it relates to the Region and to Manhattan. Demographic changes which have influenced people's trip-making patterns are used to explain past trends and to estimate future conditions. This information is intended to create the transportation and travel context for the Project's planning alternatives, and to serve as a foundation upon which to evaluate these alternatives in terms of the transportation service which they would provide, as called for by West Side Highway Project Policy Statements 25-34, as set out in Section 1.

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[30] **A Decade of Change in the Journey to Work**, Tri-State Regional Planning Commission, Interim Technical Report 4339-1302, January 1973, pp. 1, 19.
[31] *Ibid.*

Table 22 Manhattan Bound Daily Journey to Work Trips in 1960 and 1970

County and Area	Total	Total	Auto Driver and Passenger		Percent Auto Driver and Passenger	
	1960	1970	1960	1970	1960	1970
Bronx	277,718	256,673	25,831	33,059	9.30	12.88
Kings	357,108	380,077	29,462	36,497	8.25	9.60
New York	701,619	579,096	34,257	34,911	4.88	6.03
Queens	339,894	369,778	42,609	48,556	12.54	13.13
Richmond	26,133	37,786	1,063	8,269	4.07	21.88
New York City	1,702,472	1,623,410	133,222	161,292	7.83	9.94
Dutchess	493	620	124	236	25.15	38.00
Nassau	112,812	101,219	30,500	25,494	27.04	25.19
Orange	943	2,281	327	1,056	34.68	46.30
Putnam	946	1,483	271	631	28.65	42.53
Rockland	5,927	12,318	3,942	8,817	66.51	71.58
Suffolk	18,931	29,675	4,783	8,534	25.27	28.76
Westchester	73,126	71,683	14,823	17,760	20.27	24.78
New York Suburbs	213,178	219,279	54,770	62,528	25.69	28.52
Bergen	60,540	62,441	17,469	22,630	28.86	36.24
Essex	18,602	17,696	2,657	3,053	14.28	17.25
Hudson	35,051	38,066	3,043	4,944	8.68	13.00
Middlesex	6,247	12,206	1,167	2,035	18.68	16.67
Monmouth	5,877	13,795	855	2,182	14.55	15.82
Morris	6,205	8,800	1,171	1,817	18.87	20.65
Passaic	5,920	7,095	1,530	2,346	25.84	33.07
Somerset	1,863	3,650	237	419	12.72	11.47
Union	12,870	13,207	1,298	1,624	10.09	12.29
New Jersey Suburbs	153,175	176,956	29,427	41,050	19.21	23.20
TOTAL	2,068,825	2,019,645	217,419	264,870	10.51	13.11

Source: United States Census.

Regional Travel Trends 1960-1972

The shifts in population and employment during the past decade were partly responsible for and partly the result of many other changes occurring in the Region during this same period. The effects of those changes on the mix of transport services demanded become apparent as the individual influences are viewed together.

- More people are now living in the suburbs, with growth in the Outer Suburbs particularly high. Between 1960 and 1970, the Core's relative share of regional population fell by 5 percent, the Inner Suburbs' share remained stable, and the Outer Suburbs' share rose by 5 percent. The numerical increases in population were 38,000 for the Core, 559,000 for the Inner Suburbs, and 1,294,000 for the Outer Suburbs.

- Many more *workers* are living in the suburbs in 1970 than were in 1960, while the number of workers residing in the Core has declined. There were 861,000 more workers living in the suburbs, and 156,000 fewer workers living in the Core. Thus, there were fewer workers living in the area where the most public transit service is available.

- Affluence increased throughout the Region between 1960 and 1970. Median household income in 1970 dollars rose from $7,468 to $8,332 in the Core, up 12 percent; it rose from $10,093 to $11,885 in the Inner Suburbs, up 18 percent; it rose by 24 percent in the Outer Suburbs, from $9,086 to $11,279.[32] This increased affluence had a significant impact on the number of trips made, the kind of trips made, and the mode of transportation selected by travelers.

- This increased affluence has been manifested in the purchase of more automobiles. Auto ownership and multi-car households have been increasing, primarily in the suburbs. There were over 1.4 million more automobiles available in the suburbs in 1970 than in 1960. Autos available in the Core grew by about 134,000 in the same period. By 1970, there were 0.5 autos available per household in the Core, 1.31 autos available per household in the Inner Suburbs, and 1.43 in the Outer Suburbs. In addition, 40 percent of the Inner Suburb households and 46 percent of the Outer Suburb households had two or more cars. These data illustrate the tremendous growth of auto ownership in those areas least well served by the present public transit system. (See Table 23.)

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[32] **A Decade of Change in the Journey to Work**, Tri-State Regional Planning Commission, Interim Technical Report 4339-1302, January 1973, p. 24.

- Many more people used the automobile to get to work in 1970 than did in 1960. Nearly 60 percent of journeys to work in the Region in 1970 were in automobiles—up from 49 percent in 1960. The transit share of total regional journeys to work declined from almost 49 percent in 1960 to slightly less than 38 percent in 1970.[33]

- There was a dramatic growth in jobs in the suburbs of the New York Region between 1960 and 1970. For example, in the Inner Suburbs, while population grew by 11 percent, employment grew by 23 percent during the decade. In 1970, more people in nearly each county of the New York Region worked in the same county where they lived than traveled to a job somewhere outside their home county. The major exceptions to this pattern were in the Bronx, Brooklyn and Queens, where more residents went to work in Manhattan than went to jobs within their home borough.

- However, despite such changes between 1960 and 1970, Manhattan has remained the center of the Region's economy. In 1970, with the exception of Manhattan residents, more workers went to jobs in Manhattan from each county in the New York Region than had gone to work in Manhattan in 1960. The trips by people living in Manhattan to jobs in Manhattan declined by 117,000 during the decade.

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[33] *Ibid.*

Table 23 **Changes in Auto Ownership and Usage in the New York Region 1960-1970**

Autos Available	**1960**	**1970**	**Percent Change**
Core(a)	1,344,826	1,478,591	9.9
Inner Suburbs(b)	1,717,395	2,318,953	35.0
Outer Suburbs(c)	1,126,596	1,940,150	72.2
New York Region	4,188,817	5,737,694	37.0

Autos per Household	**1960**	**1970**	**Percent Change**
Core(a)	0.48	0.50	4.2
Inner Suburbs(b)	1.12	1.31	17.0
Outer Suburbs(c)	1.16	1.43	23.3
New York Region	0.79	0.94	19.0

Auto Driver and Passenger Journeys to Work	**1960**	**Percent of all Modes 1960**	**1970**	**Percent of all Modes 1970**	**Percent Change 1960-70**
Core(a)	720,424	24.3	866,360	30.3	20.3
Inner Suburbs(b)	1,221,860	68.4	1,631,312	76.7	33.5
Outer Suburbs(c)	926,083	85.4	1,477,140	89.9	59.5
New York Region	2,868,367	49.2	3,974,812	59.9	38.6

(a) The Core as defined by the Tri-State Regional Planning Commission consists of Bronx, Kings, Queens and New York Counties in New York and Hudson County in New Jersey.

(b) The Inner Suburbs are Passaic, Bergen, Essex and Union Counties in New Jersey, Richmond, Nassau and Westchester Counties in New York and the South Western Planning Region in Connecticut

(c) The Outer Suburbs are Monmouth, Middlesex, and Somerset Counties in New Jersey, Rockland, Orange, Putnam, Suffolk and Dutchess Counties in New York, and the Housatonic Valley, Central Naugatuck Valley, Valley, South Central and Greater Bridgeport Planning Region in Connecticut.

Source: **A Decade of Change in the Journey to Work**, Tri-State Regional Planning Commission, Interim Technical Report 4339–1302, January 1973.

To summarize the above material, several patterns appear from the data. The New York Region grew significantly in terms of both population and employment, with almost all of this growth in the suburbs. Affluence, measured in terms of median household income, increased throughout the Region. This new affluence manifested itself in the acquisition of many more automobiles, and the use of these automobiles for a larger share of trips made in the Region. While relatively more people worked in their home county, most counties sent more people to work in Manhattan at the end of the decade than at the beginning. In keeping with the rest of the Region, a larger share of these people used automobiles to get there, while public transit ridership decreased.

To understand and relate the changes which occurred between 1960 and 1970 to the context of the West Side Highway Project, it is necessary to narrow our attention from the Region to the Manhattan Central Business District (CBD), and to examine in more detail the changes affecting travel to and within the CBD.

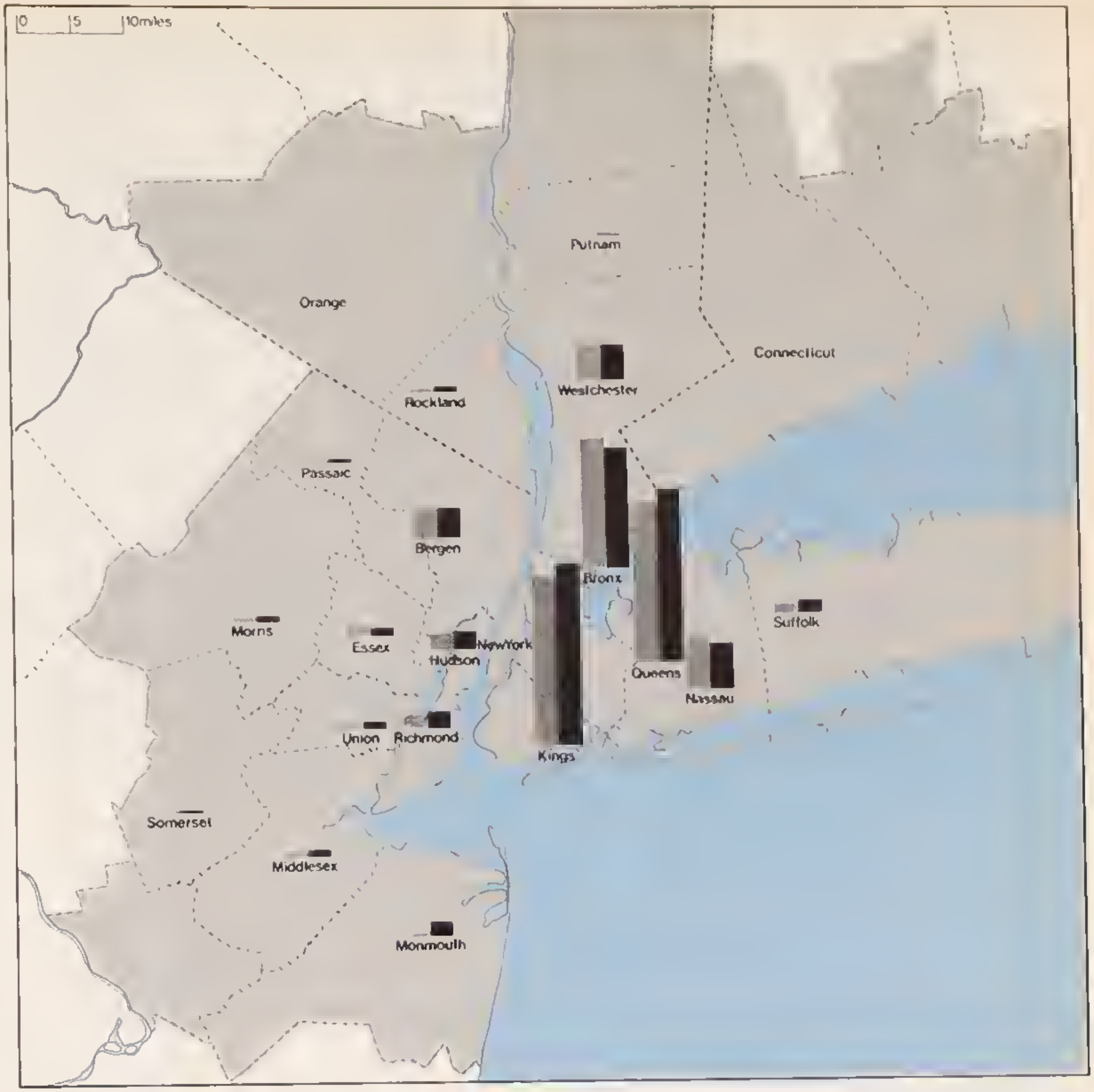


Illustration 25 Total Work Trips to Manhattan Each Day from the New York Region in 1960 and 1970

Scale of Vertical Bars: One Quarter Inch Equals 87,000 Daily Work Trips

▨ Daily Work Trips in 1960

■ Daily Work Trips in 1970

North

Rush-hour crowds like this one at Grand Central Station depend upon public transit for travel to and from their jobs in Manhattan each day.

Travel to Manhattan and the CBD

The Central Business District of Manhattan (the area below 60th Street) is both the focus of the regional economy and the center for all public transit movements in the New York metropolitan area. The economic importance of the CBD is evidenced by its 2.2 million jobs in 1967; the number has declined slightly since then, but is still over 2.1 million. Of all other cities in the United States, only Chicago and Los Angeles have resident populations larger than this Manhattan work force. The presence of so many jobs in so compact an area is possible primarily because of the large public transit system which moves people to and from their jobs in the CBD every day. The necessity of a good public transit system is underscored in the Tri-State Regional Planning Commission's **Regional Development Guide,** which has as one of its major goals the development of a regional transit system by 1990 that will "strengthen and maintain the economic viability of the Manhattan Central Business District and other dense centers."

To better understand changes in travel to the CBD between 1960 and 1970, it is important to remember certain characteristics of the various modes of travel available for journeys to the CBD.

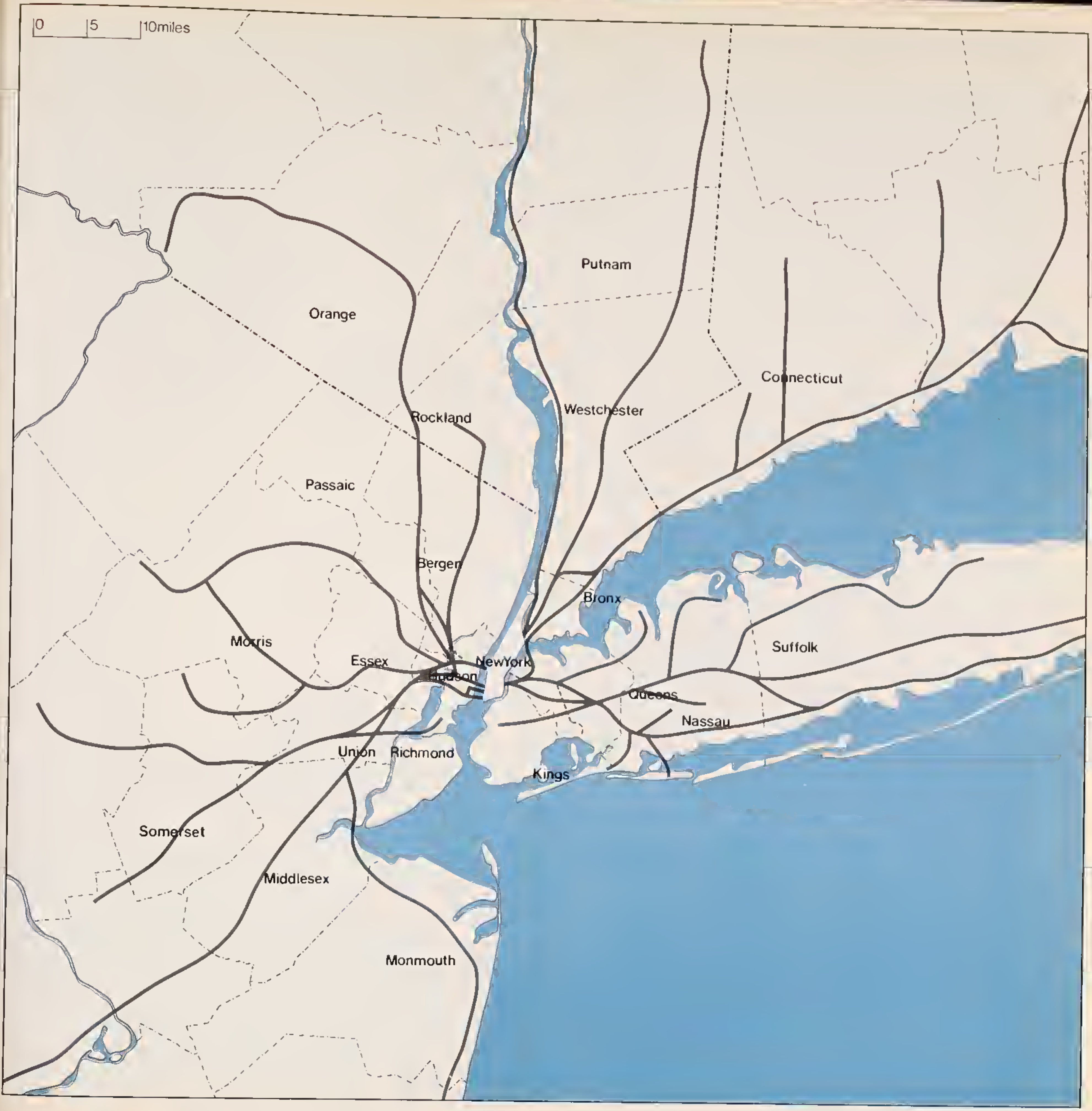
- The largest proportion of commuter rail service is provided to those people residing north of Manhattan, in Westchester County and Connecticut, and east of Manhattan on Long Island, with only limited commuter rail service west across the Hudson to New Jersey. The Long Island Railroad, which transports about 90,000 passengers daily, is the largest commuter railroad in the nation. The Hudson and Harlem Divisions of the Penn Central together carry 38,000 people per day into Grand Central Station, while the New Haven Branch transports 24,000. The Penn Central lines from New Jersey, which terminate at Pennsylvania Station, carry only 14,000 commuters daily.

Illustration 26 The Commuter Railroad Network in the New York Region

━ Existing Commuter Railroad Line

┄ Proposed Commuter Railroad Line

⊙ North


0
5
10miles
Orange
Putnam
Connecticut
Westchester
Rockland
Passaic
Bergen
Bronx
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NewYork
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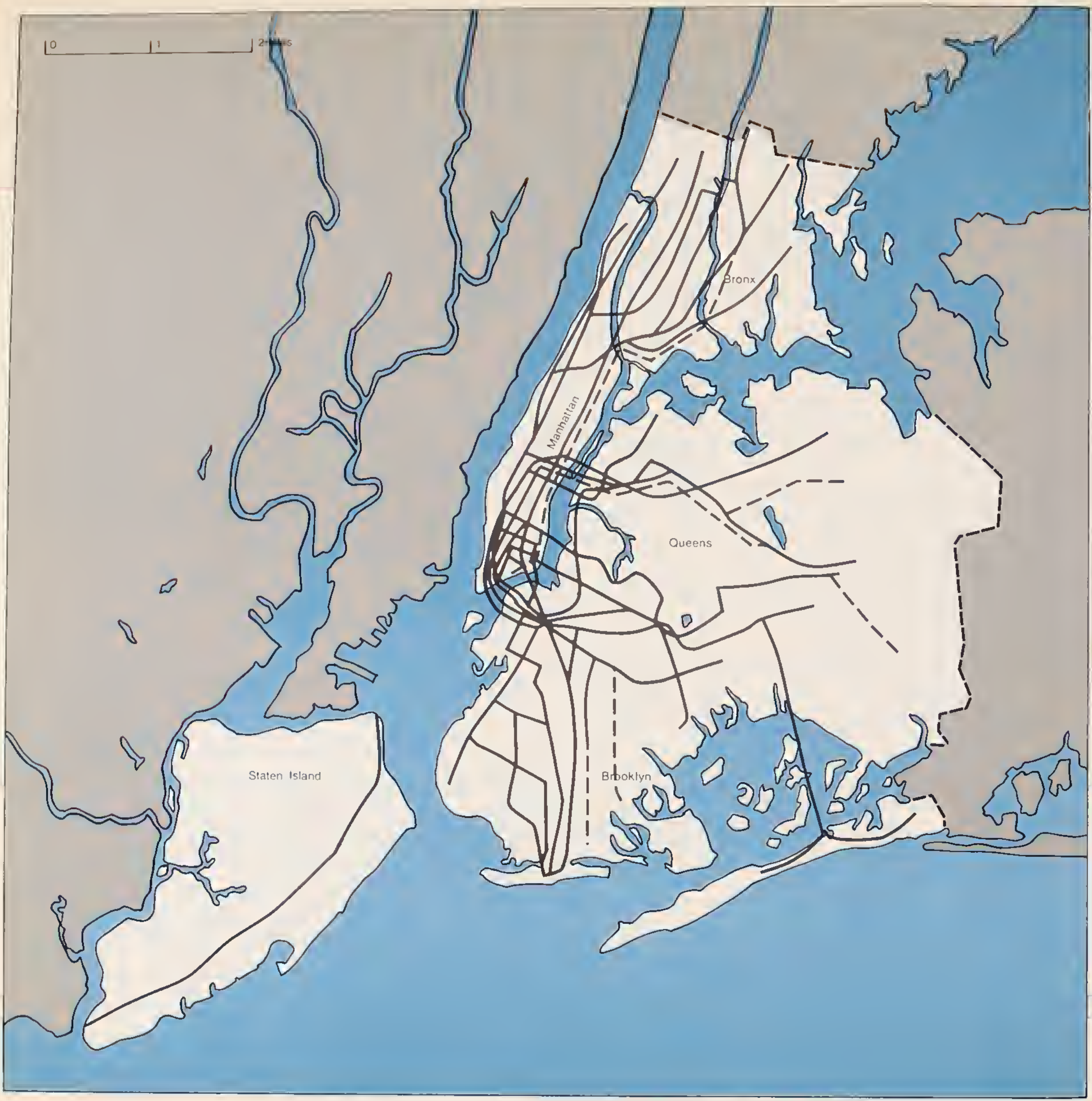
Queens
Nassau
Union
Richmond
Kings
Somerset
Middlesex
Monmouth


0
1
2 miles
Bronx
Manhattan
Queens
Staten Island
Brooklyn

- Subway service, with the exception of the Port Authority Trans-Hudson (PATH) line to New Jersey, is limited to the five boroughs of New York City. More than half—52 percent—of all subway trips each day originate in Manhattan and nearly 25 percent of all subway trips each day both begin and end in Manhattan. (See Table 24.)

- The **regional bus network** is more extensive than the rail system and carries more daily passengers. Three types of bus service are available—commuter, express and local, which differ in pickup and discharge operations in Manhattan. **Commuter buses** carry passengers from sections of New Jersey and New York State to and from the Port Authority Bus Terminal and the George Washington Bridge Bus Station. **Express bus service** from the Bronx, Queens, Brooklyn and Staten Island carries passengers non-stop to designated stops on Manhattan streets near their places of work. The **local bus system** in Manhattan primarily serves north-south movements, mostly on the eastern half of the Island where subway coverage is minimal. Buses must operate in mixed traffic with autos and trucks, thus providing a lower level of service than the subway system.

Keeping these points in mind, it is useful to look at each transit mode, as well as the auto, and see what changes in trips to the CBD occurred between 1960 and 1970.

Illustration 27 The New York City Subway System

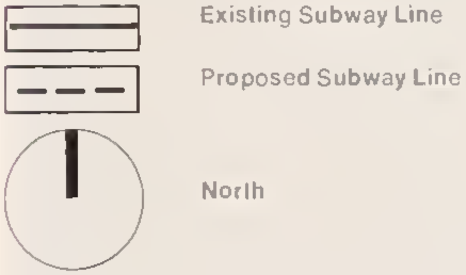


Table 24 **Where People Traveled Each Day by Subway in 1971**

Destination	**Bronx**	**Kings**	**New York**	**Queens**	**Richmond**	**Westchester**	**Essex**	**Hudson**	**Total**
Origin									
Bronx	106,902	21,369	317,942	18,379	–	827	–	720	466,139
Kings	22,185	378,868	460,359	70,822	–	232	570	2,289	935,325
New York	317,722	456,361	1,058,935	368,447	–	941	5,727	35,495	2,243,628
Queens	18,730	70,619	372,131	107,437	–	–	110	555	569,582
Richmond	–	–	–	–	18,800	–	–	–	18,800
Westchester	1,217	232	1,059	–	–	–	–	–	2,508
Essex	–	570	5,482	–	–	–	8,620	1,694	16,366
Hudson	830	2,649	35,210	667	–	–	1,682	2,249	43,287
Total	467,586	930,668	2,251,118	565,752	18,800	2,000	16,709	43,002	4,295,635

Source: **Subway Riders and Manhattan Autos**, Tri-State Regional Planning Commission, October 1971.

Public Transit

Despite increased auto usage during the past decade, the overwhelming majority of people traveling to Manhattan and its CBD still rely on mass transit to get there, though less so than in 1963. Of all 1971 daily (24 hours) person trips (a single trip made by one person) into Manhattan, 79 percent are by transit (subway, bus, train). However, including taxis, which are, in effect, public transportation, this number would rise to 87 percent. More important, during the 7:00 to 10:00 AM peak period, or rush hours, 85.3 percent of the people arriving in Manhattan come by transit.[34] If taxi occupants are included, this figure increases to more than 90 percent.

In 1971, over 71 percent of all people entering the CBD during a typical 24 hour weekday came via public transportation. During the morning 7:00-10:00 AM peak period, more than 85 percent of CBD-bound travelers came by public transportation, and for the 8:00-9:00 AM peak hour, nearly 89 percent of arrivals were on the public transit system, not including taxi passengers. Given the density of land usage in the CBD and the volume of people to be moved in and out every day, Manhattan could not conceivably function without this huge transit ridership. This crucial dependence on public transit was well-understood by the West Side Highway Project Steering Committee, which called on Project staff to "investigate the potential opportunity for utilization of mass transportation within the highway corridor."

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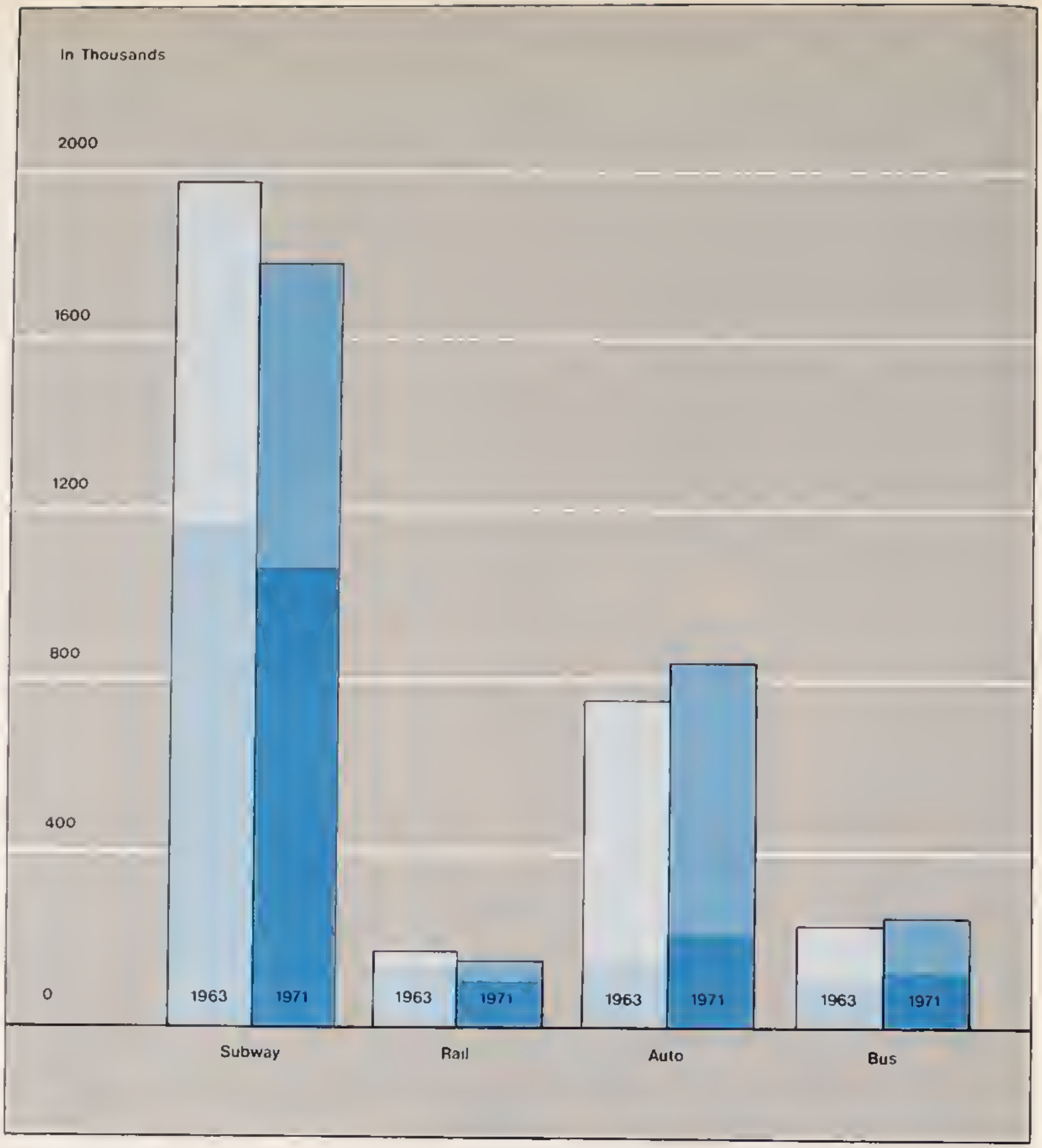
[34] **Hub-Bound Travel**, Tri-State Regional Planning Commission, February 1973, p. 4.

Illustration 28 Persons Entering the Manhattan CBD by Each Mode in 1963 and 1971



▭ Morning Peak Period in 1963

▬ Morning Peak Period in 1971

▭ Daily Total in 1963

▬ Daily Total in 1971

Although there was some shift from transit to auto by CBD-bound travelers, the absolute number of daily person trips to the CBD in 1971 was nearly equal to 1963—declining only by about 3.7 percent, or 120,000 person trips out of total of 3,290,000. The major portion of this drop was in the off-peak hours, with only a 21,000 loss during rush-hours over the eight-year period.

In 1963, 74.3 percent of people arriving in the CBD each day came by public transit. By 1971, only 71.1 percent of the daily person trips to the CBD were made by transit. This decline was greatest in the off-peak, or non-rush hour period, since there was less than a 3 percentage points decline in 7:00-10:00 AM transit arrivals, and slightly more than 2 percentage points fewer 8:00-9:00 AM peak hour arrivals by transit.

The relatively low off-peak period usage of transit is verified by 1972 New York City Transit Authority figures which showed that only about 8 percent of the 3.8 million people who rode the subways daily rode between 8:00 PM and 4:00 AM.[35] For the same time period, about 15 percent of daily vehicle arrivals occur. Nearly 60 percent of all daily subway passenger arrivals occurred in the morning three-hour rush period. Only about 25 percent of all vehicular arrivals in the CBD were in this morning period. The fact that vehicular traffic is spread much more evenly throughout the course of the day emphasizes the need for facilities to serve this travel on a 24-hour basis.

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[35] "Subway Crime Rises 26% and Patterns are Changing," New York Times, October 10, 1973.

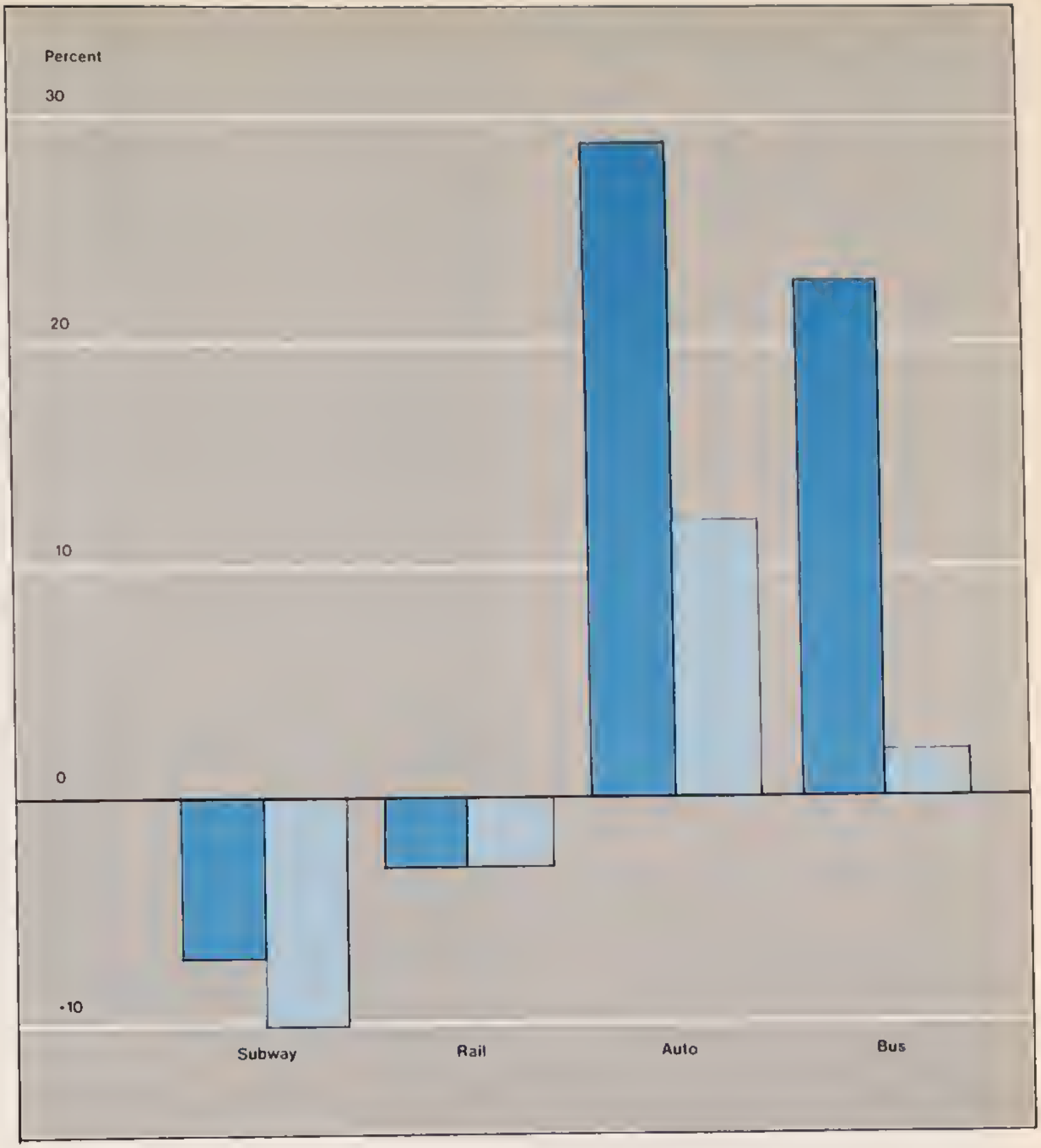

Illustration 29 Percentage of Persons Entering the Manhattan CBD by Each Mode in 1963 and 1971

🟦 Change in Morning Peak Period

⬜ Change in Daily Total

Much of the decline in subway ridership might be attributed to a loss of population in Manhattan north of 60th Street, which fell by 122,000 during the decade. During the morning peak period, 80,000 fewer people arrived in the CBD by subway in 1971 than in 1963, and the peak period decline from north of 60th Street for this same time frame was 100,000. There was a total daily decrease in persons entering the CBD by transit of 189,000, out of a 1963 total of 2,443,000 and a total daily decrease of 140,000 people from north of 60th Street.[36] Hence, much of the total and peak period drops in CBD subway arrivals could have been the result of shifts in population and work force in non-CBD Manhattan. Also, demographic changes during the decade might have resulted in more Core residents commuting to jobs in the suburbs.

However, other interrelated factors have also influenced these changes in subway ridership. Increased income, relocation of homes and jobs, and greater availability of automobiles in the Region probably have combined to reduce subway usage. In addition, the hikes in the subway fare during the period, along with the deterioration and reduction of service, especially in the non-rush periods, have probably also contributed to this drop in subway patronage. Yet, this decrease of only about 190,000 fares from a base of over 2.4 million probably does not indicate a general rejection of subways as a means of travel by the public in New York. Rather, it probably represents an adjustment of personal travel patterns in response to the various changes set out above. Moreover, the more than 2.25 million riders still using the subway in 1971 accounted for over 70 percent of the total number of people arriving in the CBD each day.

Not all public transport modes lost ridership between 1960 and 1972. For instance, if the demise of the trans-Hudson rail ferries is ignored, all the railroads entering the hub increased their patronage between 1963 and 1971. A total of 16,000 more people used these railroads daily in 1970 than did in 1960, with 13,000 of these people coming in the morning peak period.[37] This increase in commuter rail usage reflects the residential movement away from the Core, and may be due in part to an extensive modernization program carried out by the Metropolitan Transportation Authority during the past five years.

Bus passenger arrivals to the CBD have increased during the morning peak period, but off-peak bus arrivals fell 13 percent between 1963 and 1971.[38] This peak period increase has been attributed to the establishment of new express bus routes which carry people from home to work with no intermediate stops. These express buses provide a premium service for which they have been able to command a premium price.

Truck traffic is a major component of vehicle movement in Manhattan

Vehicular Traffic

While fewer people arrived in the Manhattan CBD by transit from the north, auto and taxi passengers arriving from this direction during the morning peak period increased by 18,000 between 1963 and 1971. Arrivals from Brooklyn, Queens and New Jersey were up by 13,000, 13,000 and 5,000 respectively in the morning peak period. These numbers include people driving and riding in autos, and taxi drivers and passengers. It is difficult to separate out the taxi passengers and drivers, though 21 percent of all daily person trips to Manhattan in 1971 were by auto and taxi, 9 percent of the total were auto drivers (374,000), 4 percent of the total were auto passengers (166,000), and 8 percent of the total (330,000) occupied taxis. (See Table 25.)

Table 25 Daily Person Trips to Manhattan by Mode of Travel in 1971

	Number	Percent
Subway	2,253,000	54.4
Commercial Bus	782,000	18.9
Railroad	149,000	3.6
Other	85,000	2.1
Public Transportation	3,269,000	79.0
Auto Driver	374,000	9.0
Auto Passenger	166,000	4.0
Taxi	330,000	8.0
Private Transportation	870,000	21.0

Source: **Subway Riders and Manhattan-Bound Autos**, Tri-State Regional Planning Commission, October 1971, page 13.

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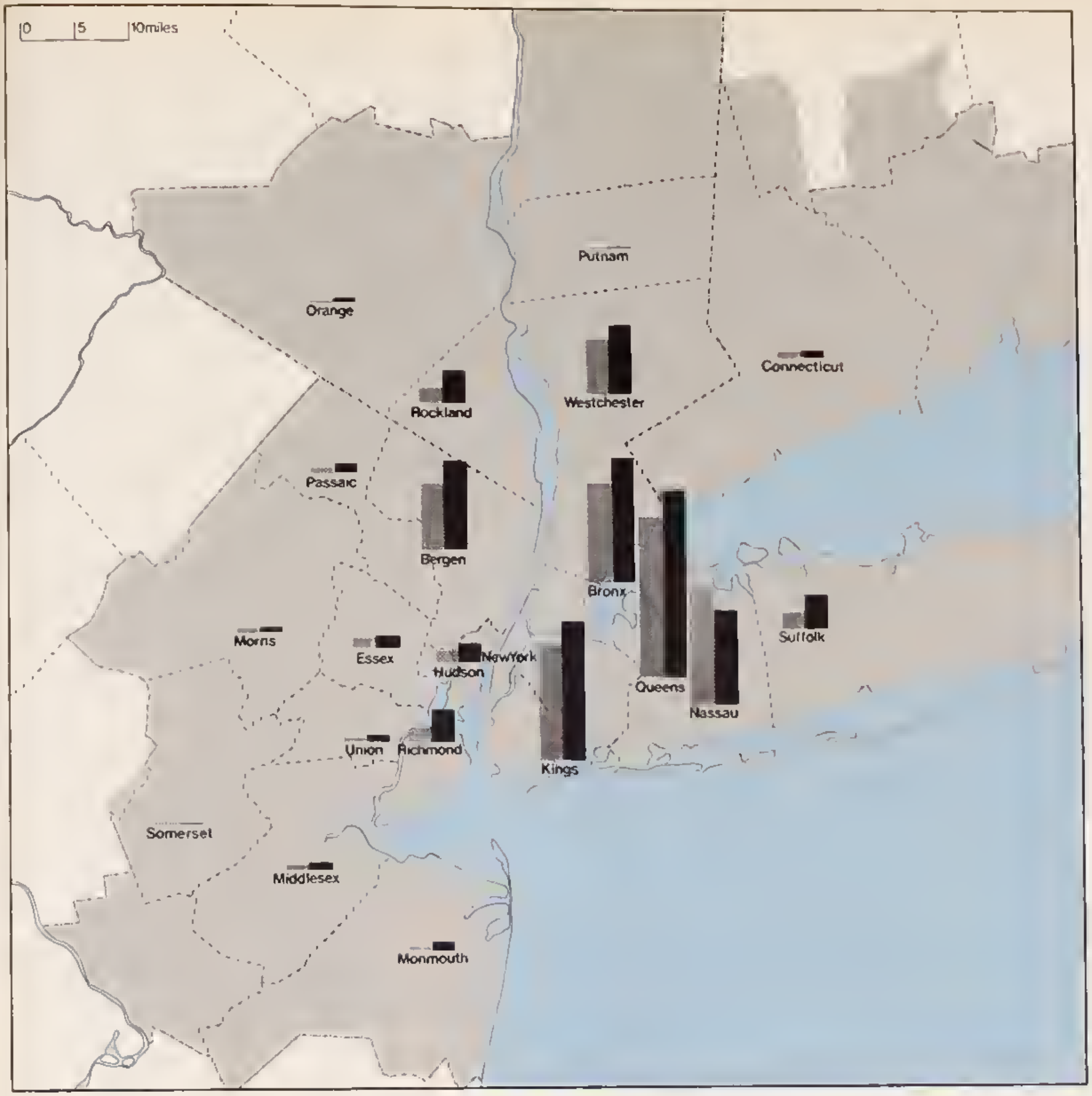
[36] **Hub-Bound Travel**, Tri-State Regional Planning Commission, February 1973, p. 5.

[37] **Hub-Bound Travel**, Tri-State Regional Planning Commission, February 1973, p. 6.

[38] *Ibid.*

Illustration 30 Automobile Work Trips to Manhattan Each Day From the New York Region in 1960 and 1970



Scale of Vertical Bars: One Quarter Inch Equals 10,870 Automobile Work Trips

▨ Automobile Work Trips in 1960

■ Automobile Work Trips in 1970

North

While the total number of people crossing 60th Street to the CBD on a daily basis declined by 109,000 (8 percent) between 1963 and 1971, vehicular arrivals from this direction rose by 37,000 (14 percent). This growth in vehicles entering the CBD from north of 60th Street was comprised almost entirely of autos and taxis, since there was a slight decrease in truck arrivals between 1963 and 1971. Nearly half of the vehicles entering the CBD on a typical weekday in 1971 crossed 60th Street.[39]

Total vehicles entering the CBD through Brooklyn, Queens and New Jersey also increased between 1963 and 1971, while the number of trucks arriving from these sectors declined. In absolute terms, the decrease in truck arrivals was much larger from these sectors than from north of 60th Street. Growth in auto and taxi arrivals from Brooklyn was more than 37 percent (39,000); from Queens it was approximately 26 percent (19,500); and, auto and taxi arrivals from New Jersey rose by about 13 percent (6,400).[40] While these numbers may seem small compared to subway statistics, the 646,000 vehicles which entered the CBD each day in 1971 represent a tremendous volume of traffic.

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[39] **Hub-Bound Travel**, Tri-State Regional Planning Commission, February 1973, pp. 7, 8.
[40] **Hub-Bound Travel**, Tri-State Regional Planning Commission, February 1973, p. 14.

When interpreting vehicular traffic data, several points should be remembered.

- The demand for road space is spread much more evenly throughout the day than the demand for subway service, which is heavily concentrated in the morning and afternoon peak periods. Less than 25 percent of all autos and taxis crossing 60th Street into the CBD each day in 1971 made the trip between 7:00 and 10:00 AM. However, more than half (51 percent) of all persons riding the subway into the CBD from north of 60th Street in 1971 made the trip between 7:00 and 10:00 AM.[41] Lumping all entry sectors together shows that nearly 60 percent of all people entering the CBD by public transit did so during the three-hour morning rush. Only about 25 percent of the people arriving by auto and taxi came during this time of the day.

- The automobile is a relatively minor mode of travel to the CBD. Fewer than 7 percent of the journeys to work destined for the CBD are made by auto drivers. Further, only one quarter of the 1.5 million daily vehicular destinations in Manhattan are auto trip ends. Approximately half of the Manhattan vehicular destinations are taxi trip ends, and the other quarter are truck trip ends.

- Because Manhattan is an island, the amount of vehicular traffic entering the borough is limited by the capacity of the bridges and tunnels across the Hudson, Harlem and East Rivers. In other words, there is a finite upper limit on the amount of traffic which can enter Manhattan in a given time period, and these vehicular river crossings to Manhattan now operate very near capacity in the peak. Much of the growth in auto and taxi arrivals in Manhattan from New Jersey is probably explained by the decline in truck traffic moving in this direction, especially during the morning peak period, since space in the river crossings vacated by truck traffic has probably been replaced by auto and taxi traffic.

- Although there were major redistributions of trips over all bridge and tunnel entrances to Manhattan from 1970 to 1972, there was almost no change in the total number of vehicular arrivals. There was a 1.5 percent increase from 1970 to 1971, and a 0.4 percent increase from 1971 to 1972—both within the margin of estimating error. These data seem to indicate that the upper limit on peak hour vehicular river crossings to Manhattan is little more than present totals, assuming no expansion in capacity. (See Table 26.)

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[41] **Hub-Bound Travel**, Tri-State Regional Planning Commission, February 1973, pp. 14, 15.

Table 26 Total Vehicular River Crossings to and from Manhattan 1970-1972

Average Annual Daily Traffic	1970	1971	Percent Change 1970-71	1972	Percent Change 1971-72
Hudson River					
George Washington Bridge	194,910	203,005	4.2	210,839	3.9
Lincoln Tunnel	86,321	88,200	2.2	89,095	1.0
Holland Tunnel	55,099	56,013	1.7	58,068	3.7
Staten Island Ferry	2,178	1,471	−32.5	1,465	− 0.4
East River					
Triborough Bridge	85,121	87,134	2.4	77,536	−11.0
Queensboro Bridge	115,545	120,555	4.3	136,445	13.2
Queens Midtown Tunnel	77,180	78,005	1.1	67,390	−13.6
Williamsburg Bridge	73,610	72,299	− 1.8	76,219	5.4
Manhattan Bridge	68,468	68,681	0.3	73,803	7.5
Brooklyn Bridge	98,000	97,168	− 0.8	103,815	6.8
Brooklyn Battery Tunnel	62,042	62,794	1.2	47,463	−24.4
Harlem River					
Henry Hudson Bridge	46,721	48,259	3.3	42,297	−12.4
Broadway Bridge	23,115	28,232	22.1	25,178	−10.8
University Heights Bridge	26,718	29,622	10.9	31,620	6.7
Washington Bridge (181st Street)	33,661	38,522	14.4	36,812	− 4.4
Alexander Hamilton Bridge	141,609	137,881	− 2.6	156,259	13.3
Macombs Dam Bridge	46,523	40,489	−13.0	39,702	− 1.9
145th Street Bridge	23,580	24,401	3.5	23,105	− 5.3
Madison Avenue Bridge	24,941	28,891	15.8	26,923	− 6.8
Third Avenue Bridge (To Manhattan)	48,110	50,548	5.1	47,454	− 6.1
Willis Avenue Bridge (From Manhattan)	61,433	53,609	−12.7	49,431	− 7.8
TOTAL	1,394,885	1,415,779		1,420,919	

Source: **Vehicular River Crossings 1972**, Tri-State Regional Planning Commission, Interim Technical Report 4390–1205, August 1973.

■ Nearly three quarters of the daily auto driver trips (a trip made by a person driving a private automobile from an origin point directly to a destination with no intermediate stops) to the whole of Manhattan originate in New York City itself. Nearly 40 percent of total daily auto driver trips to Manhattan destinations actually begin in Manhattan.[42] The next largest concentration of auto traffic to Manhattan originates in Queens—14 percent. The Bronx and Brooklyn each account for 11 percent. Only three suburban counties have significant numbers of trip origins: Westchester, New York—6 percent; Bergen, New Jersey and Nassau, New York—5 percent each. Even in New York City, where the public transit system is quite extensive, auto usage went up between 1960 and 1970. (See Table 27.)

The percentage of people arriving in the CBD in motor vehicles rises significantly relative to public transit in the non-rush hours. About 43 percent of the people arriving outside of the 7:00-10:00 AM morning peak are driving or riding in trucks, private autos or taxis. During the 4:00-9:00 PM period, only about 15 percent of the total daily person arrivals to the CBD occur, but about 24 percent of total daily vehicles arrive.[43] This is the time of the day when many people are making shopping, social, recreational and entertainment trips, and the above data give evidence of the 24-hour nature of the vehicular travel. People coming to and moving within the City during this time period rely heavily on the street and highway network.

The absolute number of trucks entering the CBD during the morning peak period declined 21 percent (4,000) between 1963 and 1971, and declined 22 percent (16,600) on a 24-hour basis. In 1971, trucks constituted only 9 percent of the total vehicular entries

Table 27 **Auto Driver and Passenger Journeys to Work in New York City**

County of Residence	1960	1970	Change 1960-70	Percent Change 1960-70
Bronx	109,850	127,049	17,199	15.7
Kings	211,945	236,170	24,225	11.4
New York	57,085	70,162	13,077	22.9
Queens	239,954	312,635	72,681	30.3
Richmond	31,385	57,610	26,225	83.6

Source: **A Decade of Change in the Journey to Work**, Tri-State Regional Planning Commission, Interim Technical Report 4339-1302, January 1973.

This section of the existing West Side Highway stretches south from 23rd Street, passing the vacant Chelsea Piers to the CBD. However, as was noted earlier in this section, there are as many truck trip ends in Manhattan as there are auto trip ends. Also, there are trucks garaged in the CBD overnight which would not appear in data on trucks entering the CBD, and there are trucks which are kept off the streets (approximately one-third of the total) during the day for servicing. Thus, the average active truck makes somewhere between ten and eleven trips per day; each time a bread truck stops at a store to make a delivery counts as the end of one trip, and its departure from the market begins a new trip. Furthermore, it would appear that most truck trips both begin and end in Manhattan. Analysis of the Tri-State Regional Planning Commission's 1963 origin and destination data shows that approximately two-thirds of CBD-bound truck trips originate in Manhattan.

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[42] **Subway Riders and Manhattan Autos**, Tri-State Regional Planning Commission, October 1971, p. 5.
[43] **Hub-Bound Travel**, Tri-State Regional Planning Commission, February 1973, p. 3.

To better understand that half of all vehicular trip ends in Manhattan are attributable to taxis, it must be noted that an important aspect of taxi operation is cruising. Due to the nature of the business, taxi drivers spend much of their time driving empty cabs in search of passengers. Project data include as one trip the movement of a taxi from the point at which it deposits one fare to the point at which it picks up its next fare, in addition to each trip made with a fare in the cab. Since about half of all taxi trips in Manhattan are made without passengers, the movements of empty taxis account for a substantial amount of all vehicles on the street and all miles traveled by vehicles in Manhattan.

To summarize the information just presented on travel to Manhattan and, in particular, to the CBD, several items are emphasized. The vast majority of trips to Manhattan are made on public transit, particularly for the journey to work. Use of the automobile for trips to Manhattan rose somewhat during the past decade, though most trips by auto to Manhattan originate somewhere in New York City. Three quarters of the vehicular trips to Manhattan are made by trucks and taxis. River crossings to Manhattan are operating at or near capacity at present and could not accommodate many additional vehicles in the peak period. Further, the maximum accumulation of vehicles in the CBD occurs around 1:00 PM each weekday, indicating that high levels of congestion are not limited to the peak periods. And, the automobile is heavily used for non-peak period trips, most of which are associated with pleasure rather than work.

PASSENGER FREIGHT SERVICE
CHARLESTON - JACKSONVILLE
CLYDE MALLORY LINES
NEXT GAS STATION 16 MILES

The West Side Highway below Canal Street was under construction in 1938

The West Side Highway

This section examines the role of the West Side Highway as a route for vehicles and people entering the Manhattan CBD. In doing so, it indicates why the Tri-State Regional Planning Commission has placed high priority on improving the Highway.

The existing West Side Highway stretches from a connection with the Henry Hudson Parkway at 72nd Street about five miles south to the Battery at the tip of Manhattan. The existing Highway, a large section of which is presently unusable and closed to traffic, is an elevated structure extending south from the Parkway over the Penn Central 60th Street Yards. Then it continues to 14th Street in the right-of-way of Eleventh and Twelfth Avenues and Marginal Street, and then to the Battery in the right-of-way of West and Marginal Streets. Known officially as the Miller Highway, it is entirely under the jurisdiction of the City of New York, which pays the costs of maintenance and operation. Designed and built in several sections, the original portion, extending from 72nd to Canal Streets, was completed in 1937.

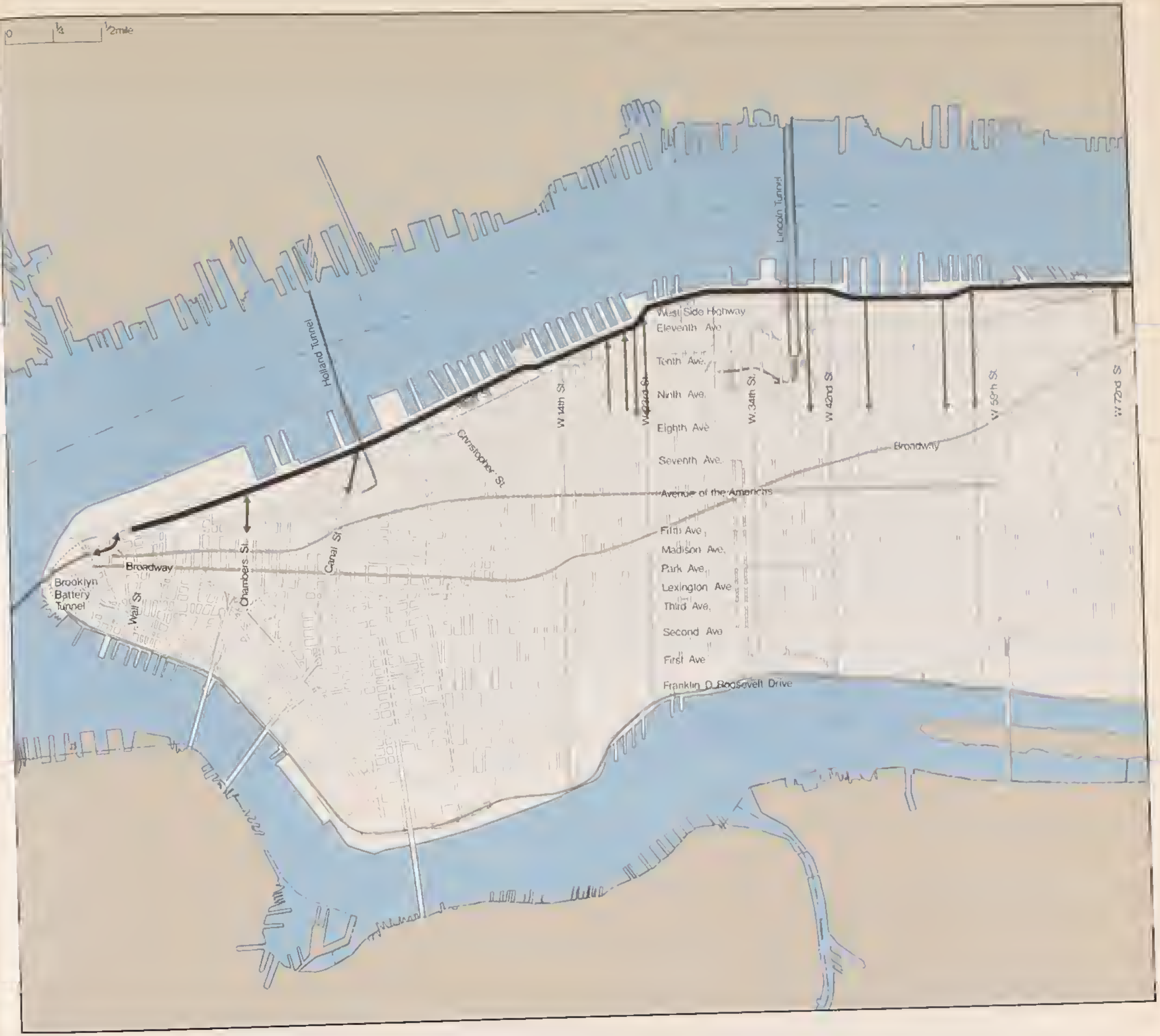
Illustration 31 The Existing West Side Highway

═ Existing West Side Highway

→ Streets with Highway Exits or Entrance Ramps

— Other Major North-South Roadways

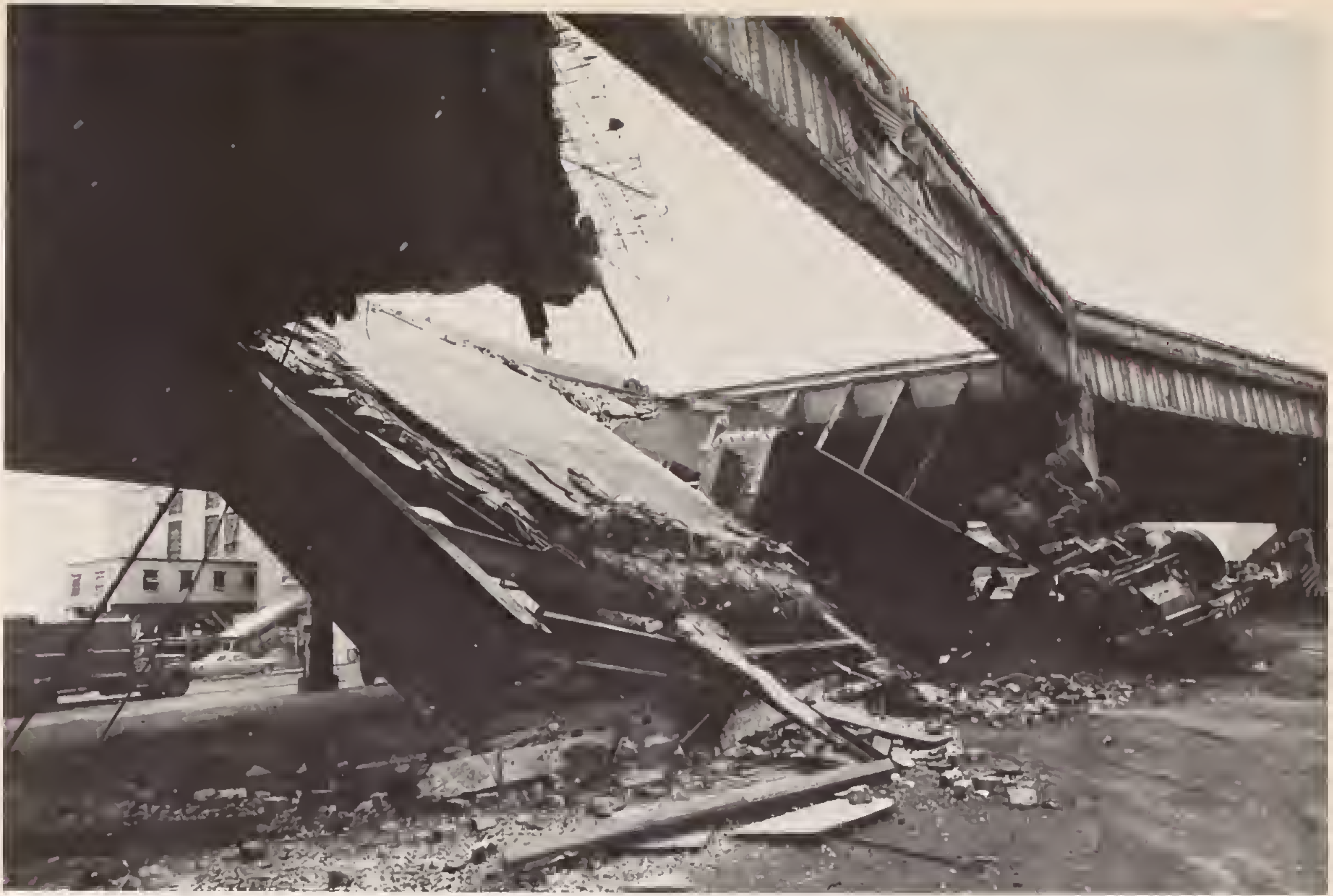
North


0
1/4
1/2mile
Holland Tunnel
Lincoln Tunnel
West Side Highway
Eleventh Ave
Tenth Ave
Ninth Ave
Eighth Ave
Seventh Ave
Avenue of the Americas
Fifth Ave
Madison Ave
Park Ave
Lexington Ave
Third Ave
Second Ave
First Ave
Franklin D. Roosevelt Drive
Broadway
Broadway
Brooklyn Battery Tunnel
Wall St
Chambers St
Canal St
Christopher St
W 14th St
W 23rd St
W 34th St
W 42nd St
W 59th St
W 72nd St

Narrow and steep ramps connect the existing West Side Highway to local streets.

This section between Canal and 72nd Streets has a system of ramps which were designed to distribute local traffic in the Midtown and Lower Manhattan areas. However, the pattern of traffic demand changed with the subsequent construction of the Lincoln Tunnel and the Henry Hudson Parkway, as well as the southern extension of the West Side Highway itself, the Brooklyn-Battery Tunnel and the Battery Park Underpass. From a solely local service facility, the Highway became a major carrier of West Side CBD traffic as well. The existing structure, which was not designed to handle the kinds and volumes of traffic these changes caused, became inadequate. Some of the existing ramps no longer served the travel movements desired by motorists. In addition, there are no direct connections between the existing Highway and the Hudson River tunnels. Thus, traffic between the West Side Highway and New Jersey has been forced to use local streets in Manhattan to get to and from the Lincoln and Holland Tunnels.

The access ramps are located unevenly along the Highway's course, with several ramps in Midtown and Lower Manhattan, but only one set of ramps in the area between. All of these ramps provide access to a street beneath the Highway known variously as West Street, Marginal Street, or Eleventh or Twelfth Avenue. Generally, it is a two-way street, but only southbound movement is allowed between 14th and 21st Streets. Free traffic flow on the cobble-stone surface is hampered by the frequent columns and irregularly located ramps.



This section of the West Side Highway at Gansevoort Street, south of 14th Street, collapsed on December 15, 1973. Ted Cowell

The deterioration of the West Side Highway has been a continuous source of concern to local public officials. The use of salt to remove ice, combined with the heavy traffic, has caused disintegration of large sections of the concrete roadway. In some cases, portions of these slabs have fallen into West Street. The black-top overlays are also in poor condition, with holes and surface cracking. The damaged concrete has been temporarily maintained by covering the holes with steel plates supported by the floor beams. There is also evidence that the steel superstructure in certain areas has extensive corrosion. Repairs to the Highway have cost the City of New York approximately $6 million for the 11-year period from 1961 to 1971, and the annual maintenance cost is increasing.

In fact, structural defects are worse than the City had previously imagined. This became apparent on December 15, 1973, when an entire 60-foot long section of northbound roadway at Gansevoort Street collapsed. This occurred under the weight of a truck carrying asphalt concrete to a site near 14th Street, where a $1 million repair job on the deck of the existing Highway was in progress. This collapse caused the immediate closing of northbound lanes in the area.

Subsequent inspection by the City of the roadway between the Brooklyn-Battery Tunnel and Midtown revealed that other serious conditions and disrepair existed at several locations on the West Side Highway. Therefore, the entire roadway south of 46th Street has been closed for an indefinite period. Further, in January 1974, the City closed indefinitely a section of the Henry Hudson Parkway between 72nd and 79th Streets, just beyond the northern end of the West Side Highway, for similar structural deficiencies. Thus, the existing West Side Highway is usable only between 46th and 72nd Streets, and traffic moving on it now must shift to local streets at either end.

Corroding steel and decaying concrete are typical of the columns supporting the West Side Highway

Sharp curves like this one at 23rd Street reduced both operating speed and safety on the West Side Highway.

In addition to the structural problems which have recently caused the closing, major deficiencies due to obsolescence have long been obvious to any driver. Highway and ramp lanes are very narrow. Curves in the road limit a driver's sight distance. Ramps are dangerously positioned on the left-hand side, and are too short and steep for safe entry and stopping. Particular safety hazards occur at Jay Street and at Pier 40, where the Highway narrows from three to two traffic lanes in a very short distance. Also, curves are not banked. In the area of 23rd Street, a very sharp "S" curve requires reduced speed, at the same point where entry and exit ramps are poorly placed, and where the road is reduced again from three to two lanes. The overall result of these deficiencies was to reduce safe travel speed to between 18 and 30 miles per hour, and to raise the accident rates. Finally, truck traffic was prohibited on the Highway by City regulation. Only automobiles were allowed to use it, causing trucks traveling north or south on the West Side to use local streets, including those passing through residential areas.

In spite of the poor condition of the roadway and superstructure, along with obsolescence of design, the West Side Highway carried approximately 24 percent (15,400) of the southbound autos and taxis entering the CBD from north of 60th Street during the morning peak period in 1971, and roughly 23 percent (48,800) of total non-peak period southbound autos and taxis crossing 60th Street.[44] Traffic varied from section to section on the Highway—from 65,400 daily trips between Church and Canal Streets, to 105,900 from 57th Street to 79th Street.[45]

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[44] **Hub-Bound Travel,** Tri-State Regional Planning Commission, February 1973, p. 14.

Of the total 24-hour two-way auto and taxi traffic crossing 60th Street from the north in 1971, 20 percent (115,700) traveled on the West Side Highway, compared with 113,000 vehicles on FDR Drive. Furthermore, of the total non-peak period two-way traffic, 20 percent used the West Side Highway.

Isolating the major avenues crossing 60th Street on the West Side—Central Park West, Seventh Avenue, Broadway, Columbus and West End Avenue, and comparing them with the West Side Highway, shows that in 1971 the West Side Highway carried more than 57 percent of the peak period southbound vehicle traffic traveling on these five streets. That the same relative share of total 24-hour southbound autos and taxis used the West Side Highway indicates it was a major artery for travel throughout the day and night. Furthermore, because of the discontinuity of the street system and the closing of some streets, a person traveling by auto on the West Side has only two continuous streets between Midtown and Lower Manhattan on which to drive, ignoring West Street and the West Side Highway. These are Broadway southbound and Church Street-Avenue of the Americas northbound.

Only 24 percent (15,400 out of 64,100) of the southbound daily traffic passing 60th Street on the West Side Highway was in the morning peak period. Therefore, 76 percent of southbound West Side Highway traffic was not in the "rush hours." These numbers contrast strongly with subway arrivals from the same direction of which less than 50 percent are in the non-peak hours.

Thus, the West Side Highway has been the major artery bringing vehicles to the CBD from north of 60th Street. The majority of the total two-way traffic using the West Side Highway has done so either in the non-rush periods, or during the peaks, but in directions opposite the peak flow. Therefore, the West Side Highway has been a 24-hour-a-day transportation facility.

If the operation of the existing West Side Highway were considered in isolation, it might appear relatively minor, in comparison with total CBD peak period arrivals, or with particular heavily used subway lines. However, the Highway is viewed more accurately as one important link in a complex transportation network. Seen in this perspective, the West Side Highway previously carried more vehicles into the CBD from the north than any other roadway, and more people every day than the Long Island Railroad, the largest commuter rail operation in the Region. Currently, however, most of the existing West Side Highway is completely closed to traffic for an indefinite period.

The closed West Side Highway serves only an occasional hiker or bike rider.

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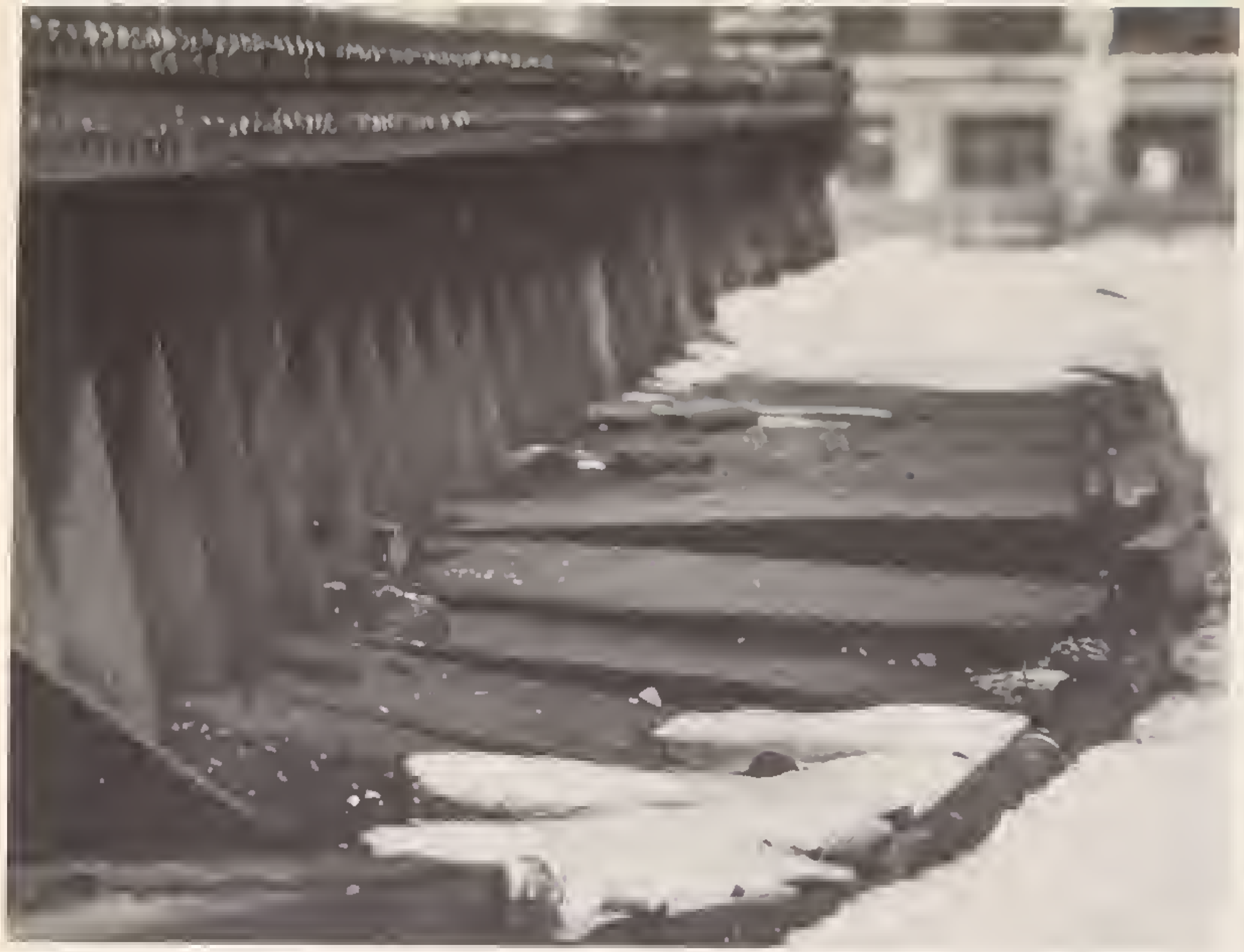
[45] 1972 Estimated Volumes based on 1971 New York State Department of Transportation counts.



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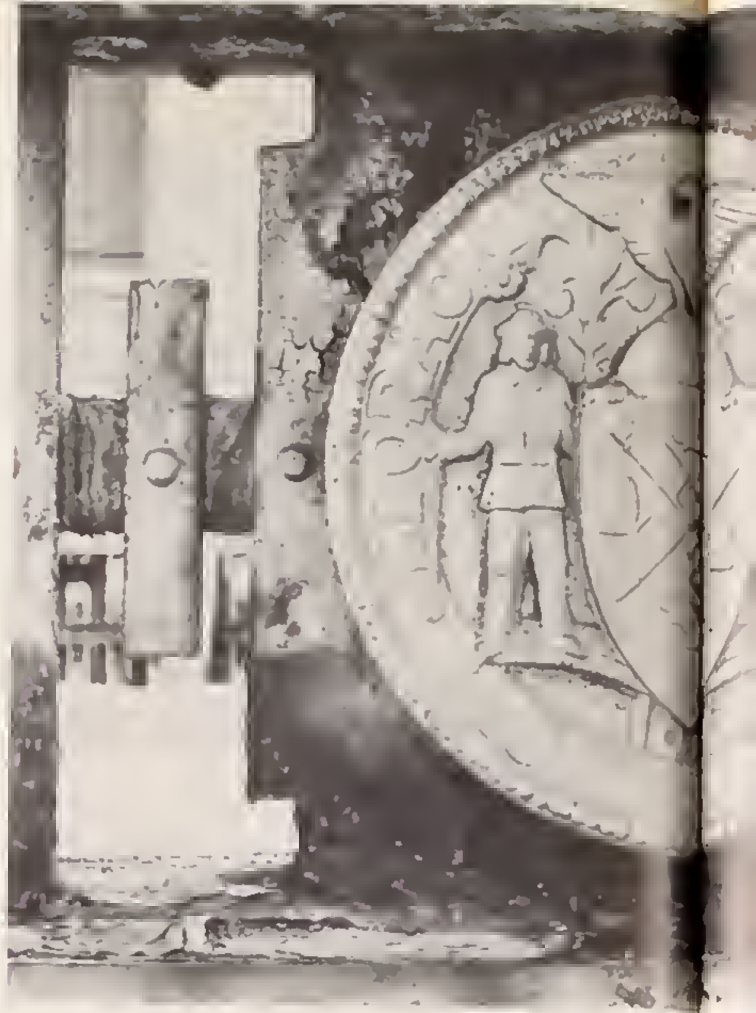
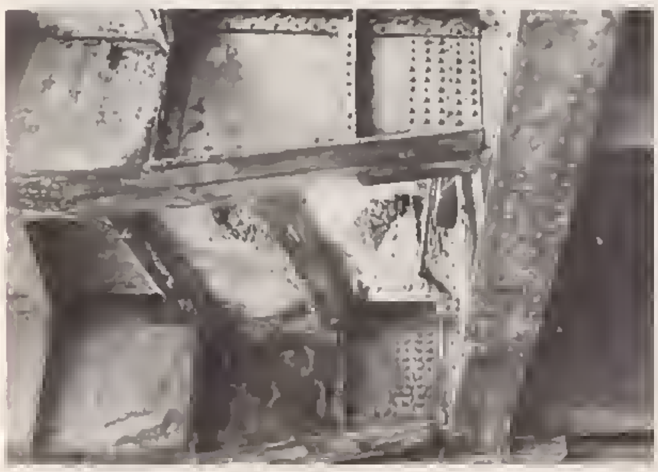


Until its closing, the West Side Highway carried large numbers of people to and from the Central Business District during every 24-hour period (4). The current conditions of the West Side Highway are illustrated by: Buckled steel plates, placed to cover holes in the pavement (1); Corroded railing and old City seal (2); Severe decay in the concrete median (3); A large hole in the roadway, penetrating through the concrete deck (5); and barricade diverting traffic to West Street, beneath the closed Highway(6).

4

2

3



5

6

Future Transportation and Travel

The changes in transportation and travel patterns described in the previous pages have taken place during a period of major demographic shifts. The growth and redistribution of population and employment, the changes in median income and other factors described earlier in this section will continue to exert a major influence on transportation. Transportation is not an end in itself, but instead plays a logistical support role for the complex set of activities which make up the New York metropolitan area, now and in the future.

The amount of person and goods movement, and how and where people and things travel in the future, depend in part upon future changes in demographic factors. Equally important, the numbers and distribution of population and employment are in part dependent upon the quantity and quality of transportation to support an estimated level of activity. This, of course, implies a balance between the supply of transportation and the logistical support it provides.

A perfect balance is never achieved because both the supply and demand change significantly over time, based upon a whole host of private and public decisions, many of which are based primarily upon factors unrelated or only indirectly related to transportation. Importantly, however, a rough or partial balancing occurs on a continuous basis. Neither the supply of transportation nor the demand for it is static.

This condition shows up in many forms, both in the short term and in the long term. Transportation supply is affected by seemingly small and short-term decisions, such as a decision to clear land of unproductive buildings or to make use of the space on an interim basis as a parking lot. Supply also is affected by major and easily understood long-term decisions, such as construction of the Second Avenue Subway.

Similarly, transportation demand is affected by seemingly small and short-term decisions, such as holding a parade in which thousands of people travel to a point where they otherwise would not be. And transportation demand is affected by major long-term decisions, such as construction of the World Trade Center, which will attract about 50,000 workers and 80,000 daily visitors.

The failure to supply either the quantity or quality of transportation demanded results over time in the lowering of demand. This is most readily recognized in such form as decisions of private business either to not locate in a particular place or to relocate from a place which is not competitive in the supply of transportation. This was discussed earlier in this section in reference to research by The Conference Board, Inc., in **Corporate Moves to the Suburbs**, and **Study of Difficulties of Doing Business in Lower Manhattan**, conducted for the Downtown Lower Manhattan Association. Both studies cited the lack of quantity or quality of both public and private transportation as factors in decisions to stay in, to leave or to locate in the Manhattan Central Business District. Thus, the financial health and vitality of the City and its ability to supply facilities and services to the public are dependent in part upon the supply of transportation.

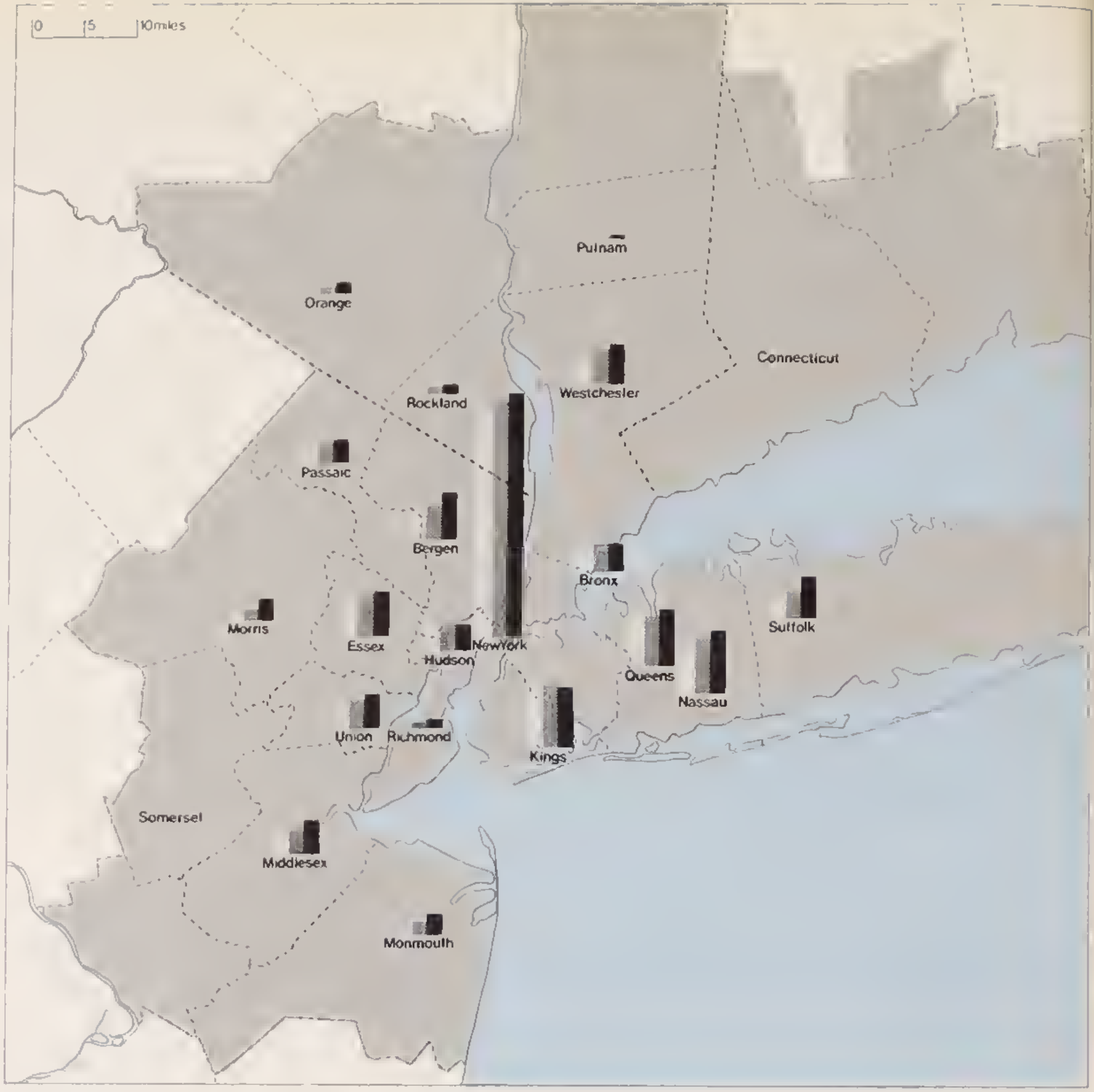


Illustration 32 Employment in the New York Region in 1960, 1970 and 1995

Scale of Vertical Bars: One Quarter Inch Equals 424,000 Jobs

☐ Jobs by County in 1960

▨ Jobs by County in 1970

■ Projected Jobs by County in 1995

North

In this context, the West Side Highway Project, along with the coordinated Manhattan West Side Corridor Transit Study, have estimated both the demand for transportation and its supply through an iterative process. Importantly, however, several other factors, some of which can be measured and quantified and some of which cannot, also must be considered in estimating transportation and travel for more than 20 years into the future. A brief discussion of such factors will be helpful at this point.

Air Quality Standards

The State and City Air Quality Implementation Plan is based upon the legal requirement to meet national air quality standards by 1975-1976. The plan contains several transportation control strategies, to be implemented for a period several years before any of the highway or transit alternatives of this Project could be implemented.

The plan states that the "core of these strategies is the replacement of older cars with 1975 and later models which are required by Federal law to have very low emission rates."[46] The plan does not contain any specific long-range control strategies which could be calculated as controls on the amount of vehicle miles traveled (VMT) in future years. The lack of guidance on future transportation controls, if any, prevented the adoption of any methodology which placed an absolute limit on motor vehicle use as a function of air quality. As a result, the Project carried out an extensive air quality analysis program in order to determine which of the alternatives presented for consideration would make the greatest contribution toward the long-term maintenance of air quality.

Priority on Mass Transportation

The City and State emphasis on the preservation and development of mass transportation, and lessening the growth and reliance on private transportation, resulted in this Project including a new mass transit facility as a basic component of its planning activity. The West Side transit alternatives are in addition to an extensive set of transit improvements already under way or programmed for the near future. Thus, the Project travel forecasts for the future are based upon the assumption and belief that the full transit improvement program, including the addition of a new West Side transitway, will be completed by the forecast year of 1995.[47]

Congestion and Parking Control

The City's long stated concern over congestion and the increasing volume of automotive traffic in Manhattan led to consideration by the City Planning Commission of adoption of a new parking policy which would limit the amount of vehicle storage space, particularly in the CBD. The City proposed such a new policy during 1973. While not yet finally adopted, the clear policy intent of the City, supported by the State, is to impose limitations on the amount of parking which can be supplied as part of new development. Specifically, the proposed policy would cut in half the amount of parking which could be built into residential buildings, as compared with existing zoning regulations. Additionally, new commercial space could be supplied on a case by case permit basis, with policy guidelines intended to limit the amount of new space substantially below that which would occur under free market conditions.[48] The Project has estimated the results of the implementation of such a policy, and has constrained the amount of automobile trips in the design year of 1995 to the maximum amount which could be accommodated in the limited vehicle storage space. This projection to 1995 was made on the basis that this proposed policy is intended to be permanent and long-range, as distinct from a temporary or short, range parking control strategy as contained in the Air Quality Implementation Plan.

Energy Crisis

The problems of energy supply and consumption have become increasingly difficult in recent years and culminated in the severe shortage of motor vehicle fuels beginning in October 1973, with the crude oil embargo imposed against the United States by Arab nations. The embargo lasted until March 1974, and the supply of motor vehicle fuel became most critical during the months of January and February

The lifting of the embargo does not solve the long-term energy problems of the nation or of the New York Region. Based upon projections by the Federal government, the energy problem will be significant for some years into the future. The President has proposed a national policy and set of programs which are designed to make the nation energy self-sufficient by the early 1980's. Whether or not this goal is achieved cannot be accurately predicted at this time.

The energy problem, especially as it applies to motor vehicle use in the West Side Study Corridor, is too uncertain at the time this is written to make any predictions which could reasonably or reliably be built into the forecasting methodology for this Project. Thus, neither the total number of person and goods trips, nor the distribution between public and private transportation, have been modified as a direct result of the energy problem.

There are several factors which are worthy of consideration in making judgments about whether the use of motor vehicles in the West Side Corridor will be significantly affected by the availability or price of fuel, including the following points.

- The change from heavy and large automobiles to smaller and lighter cars, a shift which is observed nationally and in the New York Region, will result in a higher proportion of cars which are more fuel efficient, thus permitting the same or more vehicle miles of travel on less or the same amount of fuel.

- The cost of gasoline, which has increased substantially in recent months and is predicted to increase slightly more in the short term, is not highly price-elastic. A recent study done for the Federal Environmental Protection Agency and the Council on Environmental Quality indicated that a one percent increase in the cost of gasoline would result in a 0.3 percent decrease in purchases.[49] However, a one percent increase in income would result in a one percent increase in buying of gasoline. This means that the price of gasoline must increase at more than three times the rate of growth in income in order to reduce the demand for gasoline. This factor is important, because the explicit national policy at the time this is written is that free market conditions—that is, no artificial controls such as rationing, will govern the supply and demand of gasoline.

- Observation and limited analysis of the reduction in motor vehicle use during the most severe months of the gasoline shortage indicate that the public was very selective in how it used the gasoline available. A careful collection of data and a rigorous analysis is necessary before any definitive conclusions can be reached about the effects in the Region, in Manhattan and in the West Side Study Corridor. A limited analysis, however, indicates the following general conclusions.

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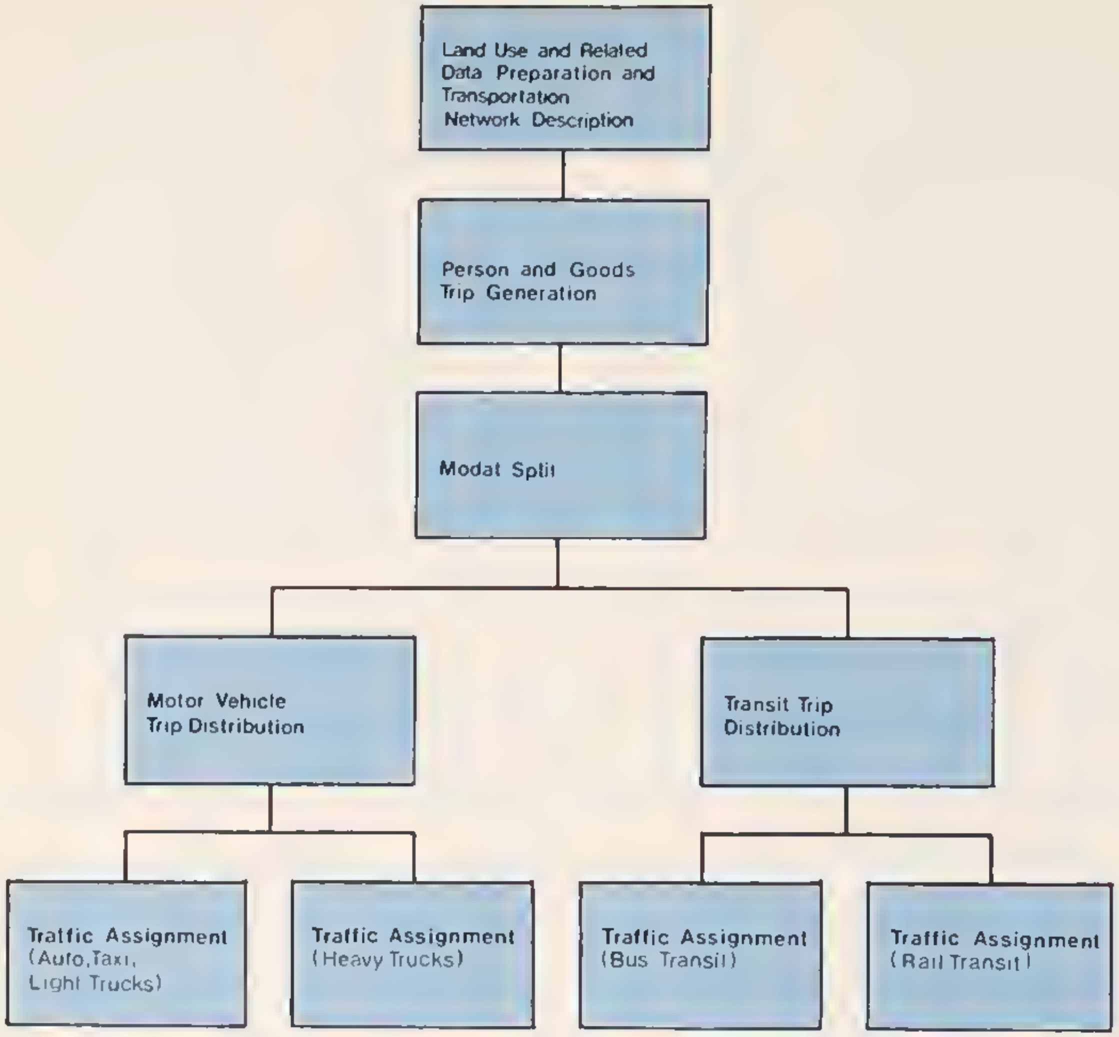
[46] **New York City Metropolitan Area Air Quality Implementation Plan Transportation Controls**, New York State Department of Environmental Conservation, April 1973.

[47] **Manhattan West Side Corridor Transit Study Draft Technical Report**, April 1974

[48] "Manhattan Off-Street Parking Regulation," Progress Memorandum to West Side Highway Project, January 28, 1974

[49] **A Study of the Quarterly Demand for Gasoline and Impacts of Alternative Gasoline Taxes**, Data Resources, Inc., Preliminary Report for Environmental Protection Agency and Council on Environmental Quality, December 5, 1973


Land Use and Related Data Preparation and Transportation Network Description
Person and Goods Trip Generation
Modal Split
Motor Vehicle Trip Distribution
Transit Trip Distribution
Traffic Assignment (Auto,Taxi, Light Trucks)
Traffic Assignment (Heavy Trucks)
Traffic Assignment (Bus Transit)
Traffic Assignment (Rail Transit)

Transportation and Travel Forecasting Procedure

First, the reduction in weekday travel was considerably less than weekend travel. Second, the reduction in motor vehicle travel was less during the daytime hours than evening hours, indicating a higher priority on work or business-related trips. Third, the reduction in peak period travel was less than for off-peak periods. Fourth, modest increases in public transit ridership did not make up for the reduction in motor vehicle travel, indicating that many person trips which otherwise would have occurred simply were not made by any mode of transportation. During the most severe period of gasoline shortage in February 1974, compared with a similar period in 1973, the reduction in crossings of the George Washington Bridge, Lincoln Tunnel and Holland Tunnel averaged 13.7 percent, with a low end of the range of 11.1 percent at the Holland Tunnel, up to 14.1 percent at the George Washington Bridge. As soon as more gasoline became available early in March, notwithstanding the price increases, motor vehicle travel started increasing. For the first 16 weekdays of March, as compared with a similar period in 1973, the reduction on the same Hudson River crossings averaged 7.5 percent, with the low end of the range of 4.2 percent at the Holland Tunnel, up to 9.8 percent at the George Washington Bridge.

Travel Forecasting

The above factors, as well as others described in this section, make the task of forecasting future conditions more than 20 years from now extremely difficult. Notwithstanding, the West Side Highway Project and the related Transit Study have estimated the total volume of people and goods movements, how they will be transported (mass transit, auto, truck, taxi), the number of persons on particular transit lines, or the number and kind of vehicles on streets at certain hours of the day.

The process of forecasting and assigning travel is not a precise science. It is instead a highly complex methodology and set of procedures which make extensive use of computers and their capacity to process massive amounts of data. The importance of the process is not in the capabilities of computer technology. It is instead the reasonableness of what the computer is instructed to consider, and how to consider it.

The West Side Highway Project and its related Transit Study used a conventional method of developing transportation and travel forecasts to 1995. The Project methodology was based upon the results of work of the Tri-State Regional Planning Commission, in order to make use of extensive technical data and procedures already worked out by Tri-State. Minor variations and refinements were made. The actual forecasting process, in a highly simplified form, consisted of a series of sequential steps, as shown in the accompanying figure.

The development of population and employment projections, as well as other data, including the number of autos available to Manhattan residents, went through several minor and major iterations and revisions before a minimum and moderate growth range was established.[50] Importantly, projections by the Tri-State Regional Planning Commission, the agency responsible for regional planning and for the Urban Transportation Planning Process, were used for all of the Region except Manhattan. The Tri-State projections for Manhattan were not sufficiently detailed to be used directly in the forecasting process. The Project developed projections based upon data from Tri-State, the Port Authority of New York and New Jersey, the Regional Plan Association and other sources, as well as its own research. The City Planning Commission worked closely with Project staff to make certain that projections were consistent with both short-range and long-range City policy. In addition, final forecasts were reviewed and revised as a result of the community participation program, in which professional consultants to three West Side Community Boards (Combo) made a major contribution to the forecasting process.[51]

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[50] **Travel and Traffic Forecasts for 1995**, West Side Highway Project Report No. 5 19, September 1973

[51] **Report on the Status of the West Side Highway**, Borough President of Manhattan and Community Boards 2, 7 and 9, Combo, December 1973

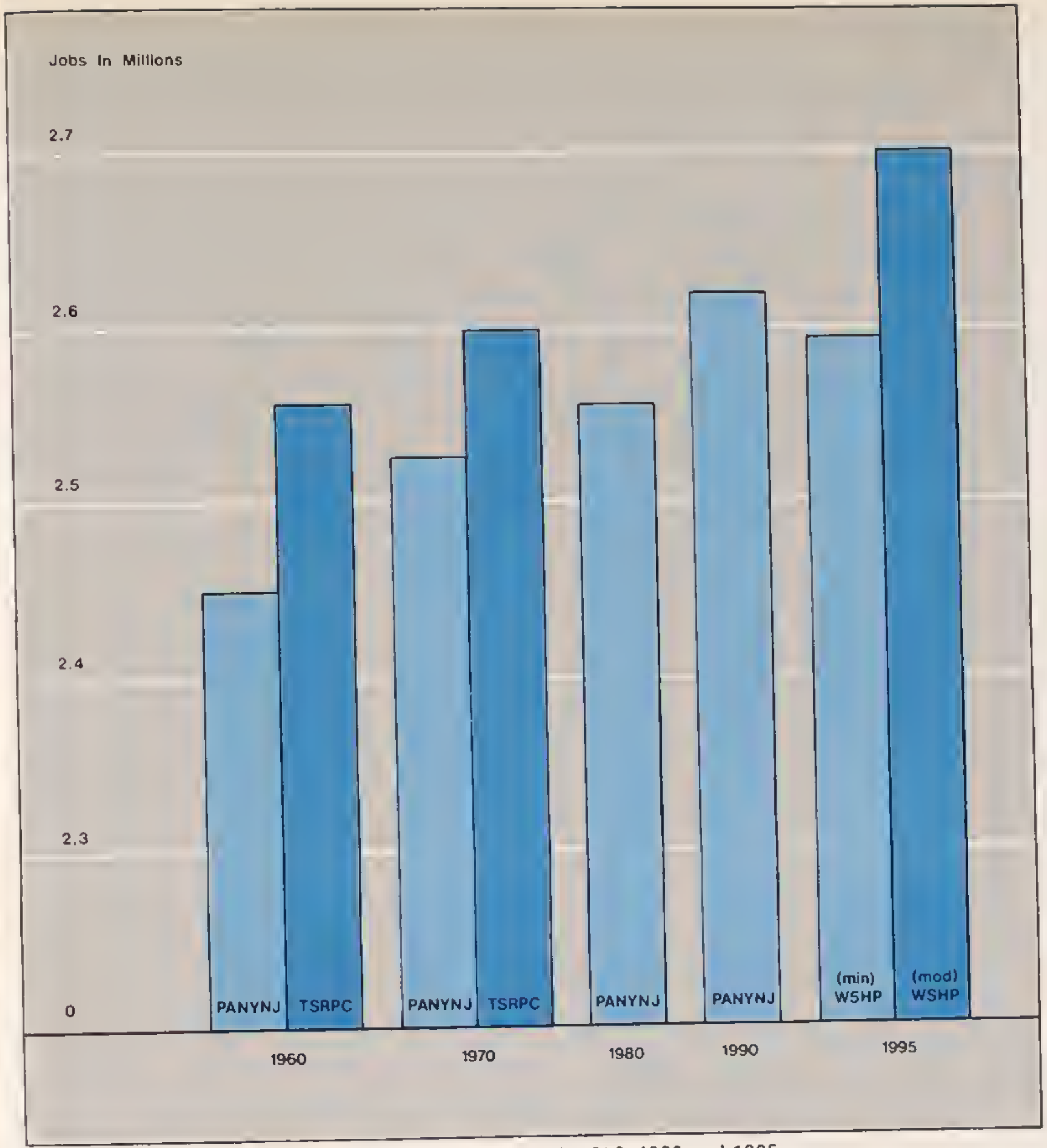


Illustration 33 Employment in Manhattan in 1960, 1970, 1980, 1990 and 1995
WSHP: West Side Highway Project TRSPC Tri-State Regional Planning Commission
PANYNJ Port Authority of New York and New Jersey

The results of the final forecasts of employment in Manhattan and the CBD for both minimum and moderate growth are shown in Illustration 33. Population and employment forecasts to 1995 estimate a continuation of past trends at the regional level, and a trend reversal in the Manhattan CBD. It is expected that most growth will continue to be in the suburbs, primarily in the Outer Suburbs, both in population and employment. However, within the Manhattan CBD, both residential and non-residential floor space are forecast to increase. Consequently, the population of the CBD is estimated to rise by between 22,000 and 100,000 persons over the next 20 years, according to the minimum and moderate growth assumptions. CBD employment is projected to increase on the order of 140,000 to 248,000 people, with minimum and moderate growth. Both of these changes, although relatively small, would reverse present downward trends. (See Table 28.)

Table 28 Manhattan CBD and Non-CBD Land Use Factors (a)

	1972	1995 Minimum(b)	1995 Moderate(c)
CBD Floor Space(d)			
Non-Residential	601.1	689.8	718.6
Residential	202.2	239.8	271.4
Total	803.3	929.6	990.0
Population			
CBD	520,000	544,000	620,000
Non-CBD	959,000	860,000	840,000
Total	1,479,000	1,404,000	1,460,000
Employment			
CBD	2,122,000	2,262,000	2,370,000
Non-CBD	351,000	321,000	321,000
Total	2,473,000	2,583,000	2,691,000
Autos Available			
CBD	57,100	69,900	80,600
Non-CBD	102,600	110,900	108,700
Total	159,700	180,800	189,300

(a) The CBD (Central Business District) is that part of Manhattan south of 60th Street. The Non-CBD is that part of Manhattan north of 60th Street.

(b) West Side Highway Project Growth Assumption "B," projecting minimum change between 1972 and 1995.

(c) West Side Highway Project Growth Assumption "C," projecting moderate change between 1972 and 1995.

(d) Millions of Square Feet

Source: Estimated by West Side Highway Project.

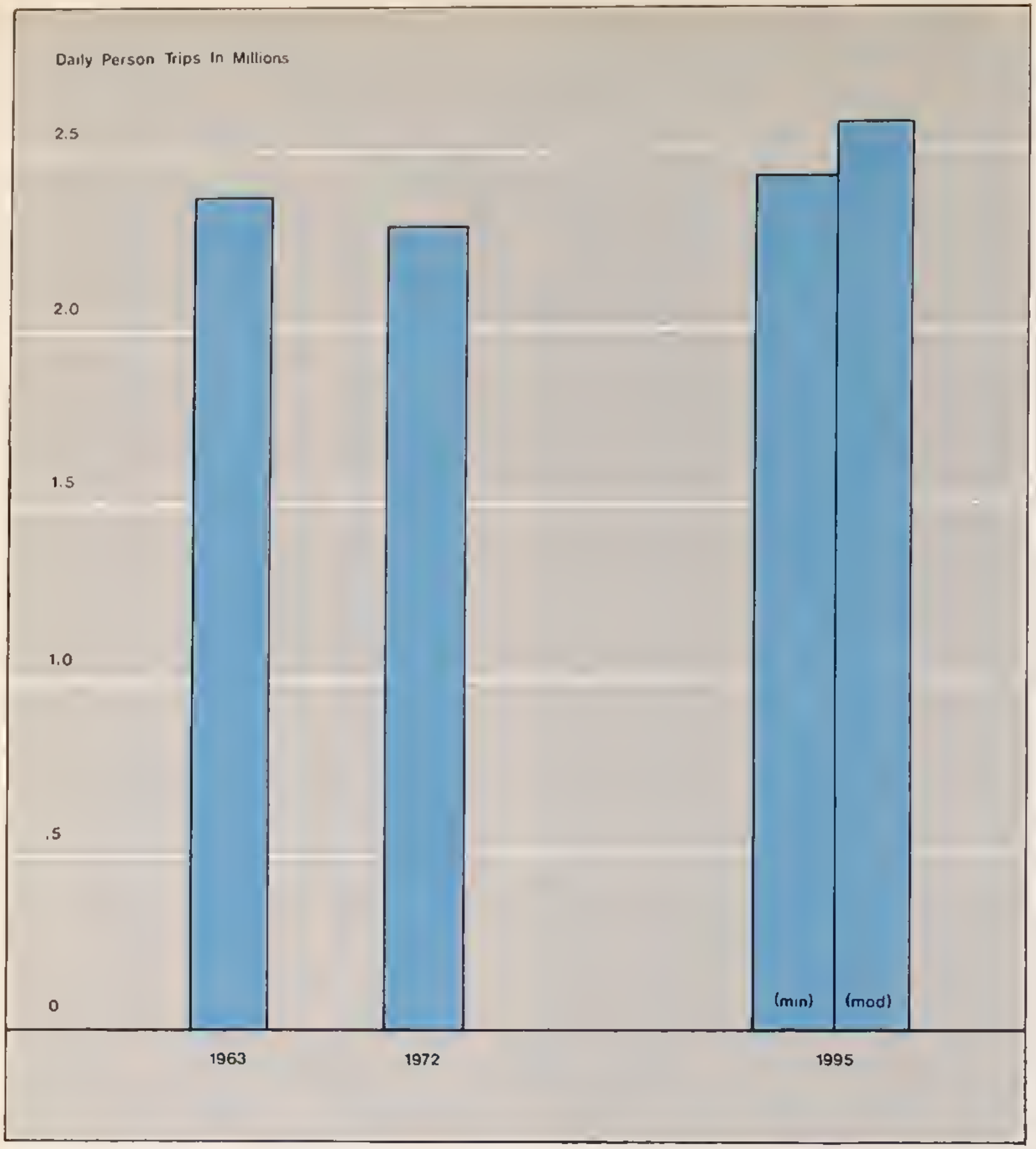


Illustration 34 Daily Person Trips to the Manhattan CBD by Transit in 1963, 1972 and 1995

During the 20-year period, population and employment are forecast to decline in the rest of Manhattan. It is estimated that the non-CBD population will lose between 99,000 and 119,000 people, and that there will be 30,000 fewer jobs in 1995 than in 1972 It is expected that in 1995 nearly nine out of every ten Manhattan jobs will be located in the CBD. This change is based upon new developments, such as the World Trade Center, Battery City Park, Manhattan Landing, and smaller developments which will add several million square feet of living and working space to the Manhattan CBD Nothing comparable is presently planned in the area above 60th Street

While population and employment in Manhattan are forecast to decline north of 60th Street and to increase in the CBD, the number of automobiles available for residents use is expected to grow throughout the Island. In the CBD, auto availability growth is forecast to be between 12,800 and 23,500 autos, for minimum and moderate growth North of 60th Street, it is estimated there will be about 6,100 to 8,300 more automobiles. The net result of such an increase in autos available will be more auto trips by Manhattan residents, which will be made in the off-peak periods.

Estimates of 1995 person trips were developed for both the minimum and moderate growth projections, utilizing a mathematical process of regression analysis and the development of growth equations Estimates of 1995 person travel for both the minimum and moderate growth projections were converted to estimates of person trips made by mass transit and vehicle trips by auto and taxi. The limitation on parking space discussed earlier significantly influenced this calculation. Separate estimates of future truck and taxi trips were prepared and these, added to the automobile trips, completed the estimates of motor vehicle travel for the two growth projections to 1995. (See Table 29.)

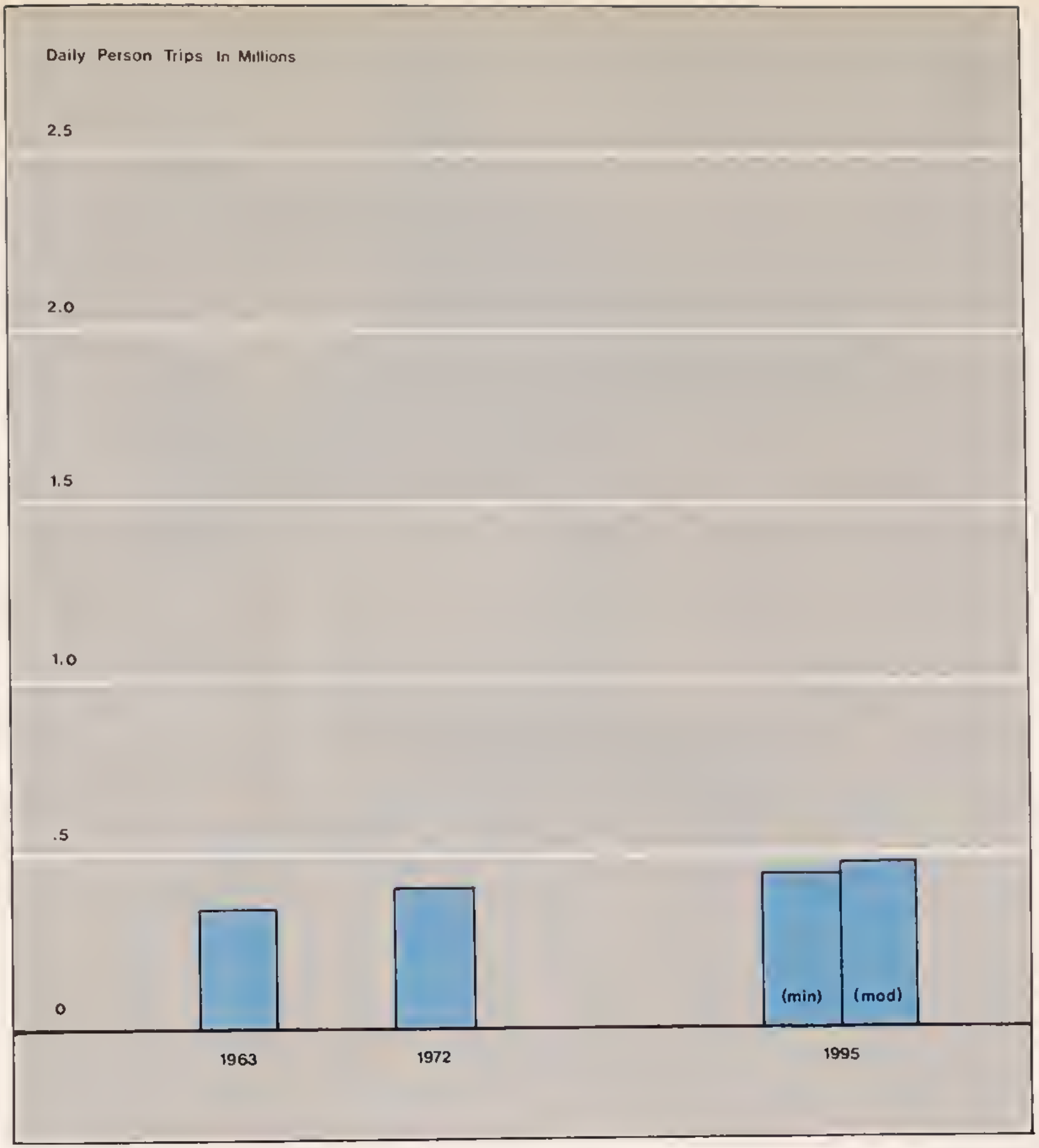


Illustration 35 Daily Person Trips to the Manhattan CBD by Automobile in 1963, 1972 and 1995

Table 29 Daily Person Trip Ends in the Manhattan CBD and Non-CBD (a)

	1972	1995 Minimum(b)	1995 Moderate(c)
CBD			
Person	2,507,900	2,712,000	2,872,900
Auto Driver	283,100	333,000	345,000
Taxi	586,800	632,200	700,700
Truck	294,000	301,500	324,500
Non-CBD			
Person	995,500	964,200	963,400
Auto Driver	237,500	242,900	243,300
Taxi	344,400	334,000	331,800
Truck	140,000	152,300	159,300

(a) The CBD (Central Business District) is that part of Manhattan south of 60th Street. The Non-CBD is that part of Manhattan north of 60th Street.

(b) West Side Highway Project Growth Assumption "B," projecting minimum change between 1972 and 1995.

(c) West Side Highway Project Growth Assumption "C," projecting moderate change between 1972 and 1995.

Source: Estimated by West Side Highway Project

Special note is made of the forecasts of truck trips for the minimum and moderate growth estimates because they represent a reversal in the trend of recent years, in which truck travel has been decreasing. Some caution should be exercised in almost all analysis of truck trips and travel because the amount and detail of the data are not nearly as complete as for other kinds of travel. Notwithstanding, Project forecasts for 1995 estimate increases over 1972 of truck trip-ends in the Manhattan CBD of 2.5 percent for the minimum growth forecast, and 10.4 percent for the moderate growth forecast. In the portion of Manhattan north of 60th Street, the estimated increase for truck trip ends is 8.8 percent and 13.8 percent.

Decreases in area truck travel in recent years probably have resulted primarily from the sizeable decreases in maritime, industrial and manufacturing activities and their associated blue-collar employment. The estimated increase in truck trips to 1995 results from a significant slowing down of the rate of decrease in manufacturing and other industrial employment, and a more than offsetting increase in commercial activity and employment. This kind of increase is associated largely with service truck trips, such as maintenance and repair, delivery of food and paper, and refuse removal.

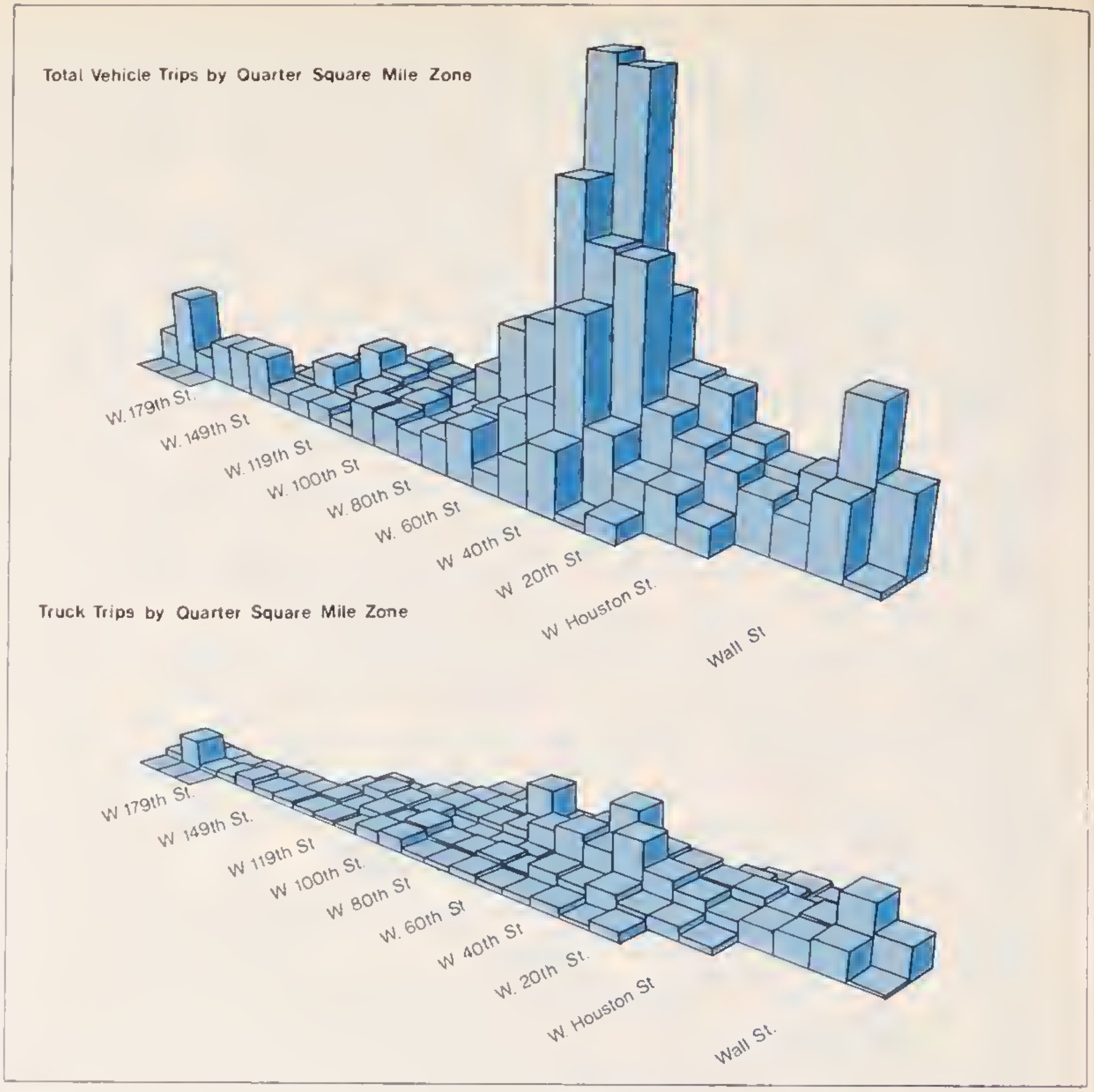
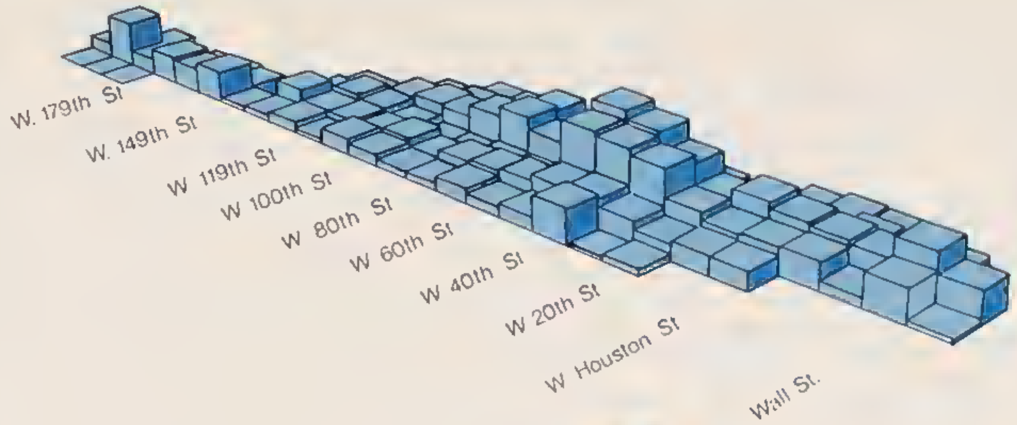
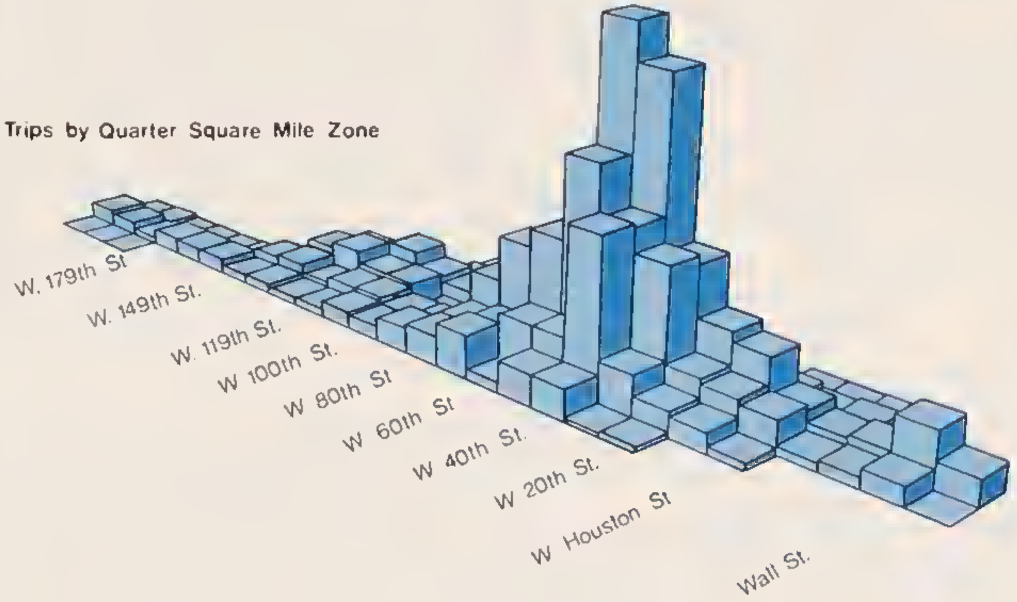


Illustration 36 Projected 1995 Vehicle Trips to Manhattan
Minimum Growth Assumption

Auto Trips by Quarter Square Mile Zone



Taxi Trips by Quarter Square Mile Zone



In addition to the above described procedures and their results, one other significant step was taken which is not shown in the simplified Transportation and Travel Forecasting Procedure figure. This activity was a special set of studies and analyses which estimated the amount of diversion of auto travel to transit under the two West Side transit alternatives—express bus and rail.[52] The amounts of diversion from each transit alternative were subtracted from the automobile trip totals and added to the transit trip totals before the final set of assignments were made to the various networks as indicated in the figure

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[52] "Estimate of Diversion to Transit for 1995 CMR Vehicle Trip Table," West Side Highway Project, November 6, 1973

"Estimating Transit Travel for the Manhattan West Side Corridor Transit Study," West Side Highway Project, December 1973

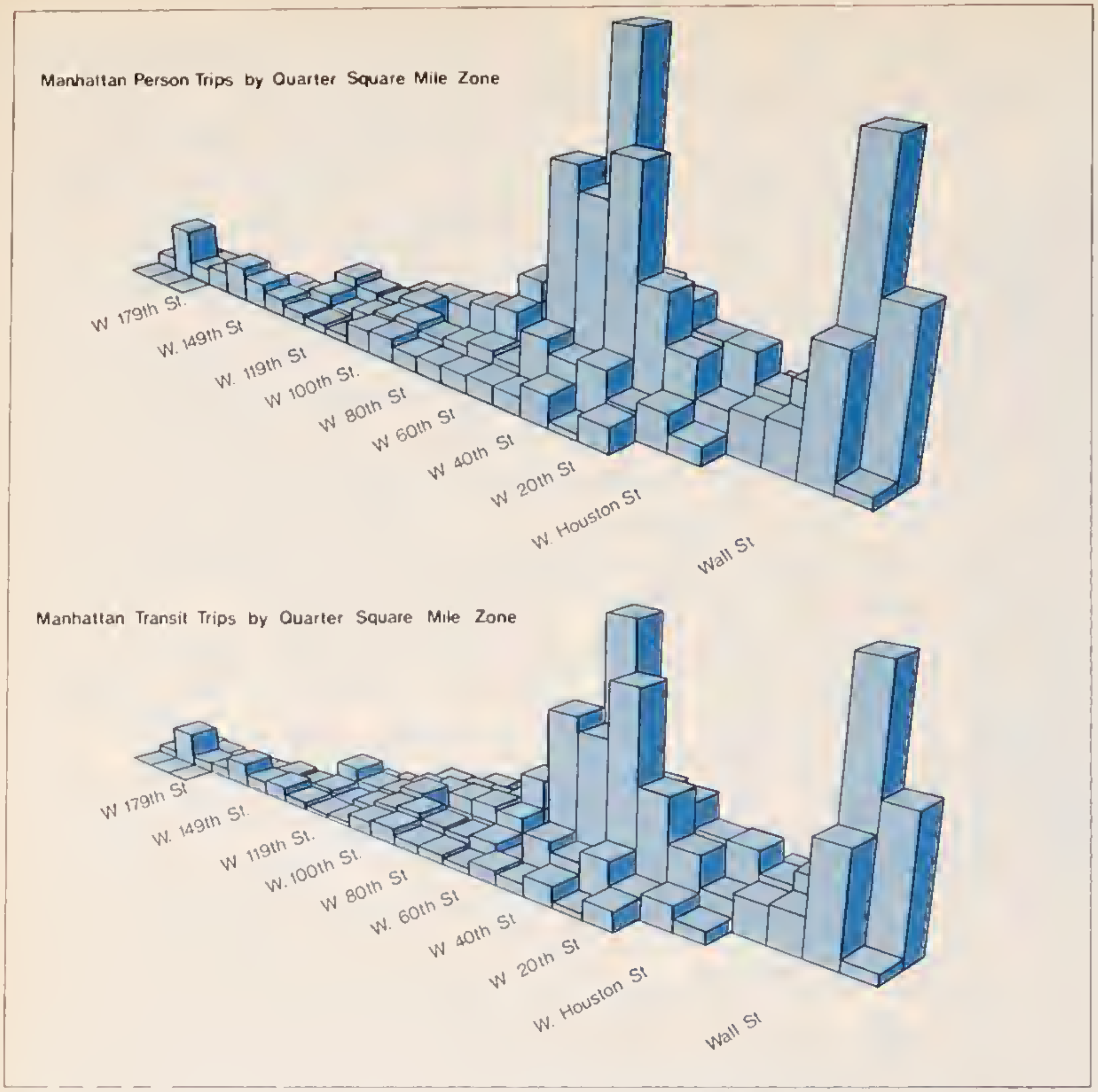

Illustration 37 **Projected 1995 Person Trips and Transit Trips to Manhattan**
Minimum Growth Assumption

Perhaps one of the most important results of the process was the forecast that the long-term downward trend in mass transit ridership will be reversed during the period between now and 1995. Mass transit service as a total has been experiencing a decline in ridership on an annual basis since the years immediately after World War II. The Tri-State Regional Planning Commission, in its most recent updating report, calculated that the total number of mass transit riders entering the CBD on an average weekday basis had declined eight percent between 1963 and 1971.[53]

The total decline, however, was based upon a reduction of ten percent by subway, three percent by commuter railroads, and an increase of two percent by bus. This is discussed more completely in the **Manhattan West Side Corridor Transit Study Draft Technical Report.** The actual forecast increase in mass transit ridership is 5.9 percent for the minimum growth between 1972 and 1995, and 12.7 percent for the moderate growth projection.

The discussion contained in this section has attempted to summarize past occurrences and highlights which have significantly affected the Region, Manhattan and the West Side Corridor. It also has presented the methodology of forecasting transportation and travel in the future, and most importantly, has attemped to present and discuss the effects of the forecasts, based upon the most thorough and complete data and information the Project could collect, analyze and use in looking toward the final decades of the century. Importantly, it sets the stage for the presentation and assessment of a wide range of alternative transportation proposals, on which the public can express its preferences.

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[53] **Hub-Bound Travel,** Tri-State Regional Planning Commission, February 1973.

The Alternative Proposals

Section 3 The Alternative Proposals

Development of Project Alternatives

The five alternative proposals which are described and evaluated in subsequent sections of this report represent a wide range of possible actions on the West Side of Manhattan, each centered around a different proposed transportation facility to serve the area in place of the existing West Side Highway. The range of alternatives extends from little or no change in existing conditions within the Study Corridor, to ambitious proposals for transportation and waterfront development which could transform the West Side of Manhattan over the next quarter century

The alternative proposals would provide different levels of transportation service, and include various combinations of public transit and highway facilities. Different development opportunities, some of which could be carried out directly as part of the transportation project, would arise with the implementation of each proposal. And, importantly, the alternatives would provide significantly different incentives for the preservation, development or redevelopment of adjacent areas and activities in the Study Corridor

These five alternatives are the products of an intensive process of analysis and deliberation. The goals, objectives and policy considerations developed at the beginning of the Project, along with legal and administrative requirements and physical constraints, provided the bases for the planning process and the initial development of alternatives. Starting with 17 theoretical locations for a replacement of the existing West Side Highway, the number was gradually reduced during several phases of the Project to the ones presented here. These represent real and significant choices among alternatives which would produce significantly different effects, as measured against the policies of the Project Steering Committee, and the goals and objectives of West Side Community Boards.

Policy Considerations

For nearly 20 years, attention and effort have been periodically devoted to plans for rebuilding, remodeling or replacing the West Side Highway. But until recently, neither the City nor the State had the fiscal capacity to implement such a proposal. Thus, continuous maintenance was the only realistic alternative. However, in 1970 and 1971, the City and State reassessed the status of the Interstate Highway Program as it related directly to New York City Based on the findings of the Wateredge Development Study and previous reports on the existing West Side Highway, this reassessment led to the request and eventual approval by the Federal Highway Administration of interstate designation from the Brooklyn-Battery Tunnel to the Lincoln Tunnel, with an intermediate connection at the Holland Tunnel. These are three of the four Interstate System connections across the Hudson River to New York City and Manhattan.

Formal designation as part of the Interstate System permitted the utilization of Federal-Aid Highway Trust Fund monies to plan and design a new transportation facility on the West Side, with the United States Government paying 90 percent of the cost. For the first time, comprehensive planning for replacement of the existing facility in the context of the future of the West Side was given serious consideration. Formal designation also meant that planning and proposals would be subject to all the regulations, procedures and standards of the New York State Department of Transportation, the Federal Highway Administration and the United States Department of Transportation. These regulations include those relating to the environment and public participation in the planning process.

These regulations provided the opportunity to expand the conventional highway planning process, in order to consider a broad range of possible actions and their effects. Major Federal legislation, including the National Environmental Policy Act of 1969 and the Clean Air Act of 1970, along with a series of Federal administrative requirements, and recent Federal court decisions interpreting these and other statutes and regulations, have all combined to facilitate significant expansion of the scope and precision of transportation planning in urban areas. Thus, three of the five proposals presented in this document do not even involve Interstate System facilities, and therefore are not eligible for funding under the Interstate Highway Program. Notwithstanding, these non-interstate alternatives received the same careful study and analysis, both to ensure compliance with legal requirements, and to respond to local community concerns. West Side community residents and organizations strongly expressed the opinion that a full range of alternatives had to be developed and considered by the Project in order to permit effective decision-making.

This widespread concern for a broad range of alternatives was reflected in a requirement by the New York State Legislature that the feasibility of a transportation corridor in New Jersey be considered by New York State as an alternative to a new transportation facility on the West Side of Manhattan. Prior to the start of the West Side Highway Project, such a study was conducted by the New York State Department of Transportation, and was submitted to the Legislature. Its findings and conclusions were that a new highway facility in New Jersey could not serve as a replacement for the existing West Side Highway, and could not provide the same functional service.[54]

At the outset of the Project, the goals and objectives of the participating West Side Community Boards, as well as those of the participating State and City agencies, were put before the Steering Committee, discussed and developed into a formal policy statement, and adopted by the Steering Committee.[55] This document set the parameters for the initial range of Project alternatives, and provided guidelines for transportation and related planning.

An important policy adopted by the Steering Committee was that any new transportation improvement should be designed as a replacement facility for the existing West Side Highway in terms of location. Thus, the transportation corridor was defined as the area between the Brooklyn-Battery Tunnel and the Lincoln Tunnel, extending from the fronts of the buildings along the east side of West Street and Twelfth Avenue out over the River to the United States Pierhead Line, which is located generally along the ends of the finger piers now extending into the Hudson.

Another fundamental policy, proposed by the City and adopted by the Steering Committee, was that the capacity of the bridges and tunnels leading to Manhattan not be expanded to allow more traffic to enter the Island. Since these bridges and tunnels presently operate at close to practical capacity during the peak periods, a replacement facility could be limited in size, yet designed to provide reasonable capacity for traffic generated internally within Manhattan. Further, it could provide for a functional change to encourage as many trucks as possible to divert from local streets to a new or reconstructed highway.

Most importantly, the Steering Committee specifically acknowledged that the City of New York places highest priority among means of travel upon public mass transportation. Therefore, planning for a transit facility in the transportation corridor coincided with planning for a replacement highway. The transit facility was to be designed to encourage diversion of persons from automobiles to transit, and to absorb future increases in commuter trips from outlying areas to Manhattan.

Planning and design for a replacement facility was also guided by City, community and Steering Committee desires for minimum physical disruption to the West Side. Except where penetration would occur at interchange connections, the highway components of the proposed alternatives were to cause little or no disruption to upland areas. At the Holland Tunnel, for example, several complete land use and engineering alternatives were developed in order to preserve existing buildings and economic activities. Special studies were conducted of all major ongoing and proposed development projects within the Study Corridor, in order to ensure compatibility with Project proposals. The potential for social and economic disruption was also analyzed, especially the impact on existing recreation facilities, such as the Morton Street Pier and Waterside Park, and the continued viability of maritime, trucking, rail, printing and meat processing activities on the West Side.

Photo/New York Times

Project policies were developed and implemented within a framework of public deliberation and community participation

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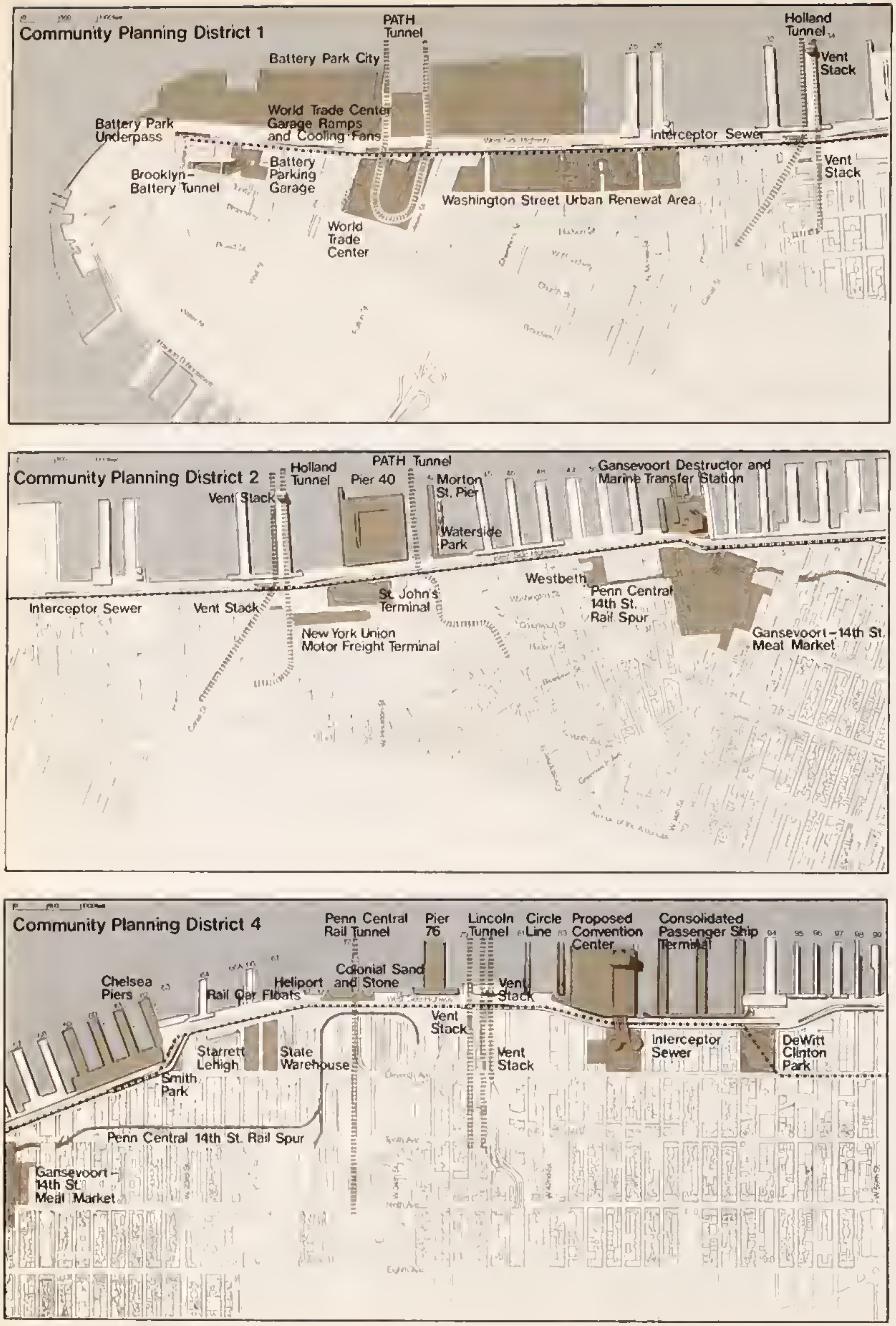
[54] **Feasibility Study Report on a New Jersey Alternative to the West Side Highway,** New York State Department of Transportation, March 1972.

[55] **Policy Statement of Steering Committee,** West Side Highway Project Report No. 2.01, August 1972.

Illustration 38 Physical Constraints in the Study Corridor

North



Physical Constraints

Major physical obstacles, many of which are unnoticed by the average citizen, often are key influences on the planning and design of new public facilities. Along Manhattan's West Side waterfront, such obstacles are abundant. They presented serious constraints on the range and configuration of possible transportation alternatives for the area.

Five major tunnels under the Hudson River lie buried beneath the Project Study Corridor, three of which have permanently fixed ventilation systems. Substantial existing structures, such as the Battery Garage and World Trade Center in Lower Manhattan, Pier 40, Morton Street Pier, and the Gansevoort Destructor in Greenwich Village, and the Chelsea Piers, Thomas Smith Park, the Circle Line Pier and Pier 76 in Chelsea and Clinton presented unique design constraints in each of the focal Community Planning Districts.

Existing commercial activities in adjacent areas, especially near the Holland Tunnel where trucking and printing predominate, at the Gansevoort-14th Street Meat Market, and in the Penn Central 30th Street railroad yards, presented physical and economic conditions which would require considerable special attention. These obstacles, as well as buried utility lines under West Street, complicated planning and design in an area where extensive landfill and variable subsurface conditions already presented severe engineering difficulties.

An interdisciplinary staff was critical to the planning and design of Project alternatives

Transportation Planning

Investigation and analysis of specific transportation elements, such as highway alignments, public transit facilities, and the social, economic and environmental conditions of the Study Corridor, began simultaneously with the development of Project goals, policies and constraints. The complex relationships among these factors on the West Side, as pointed out in the Steering Committee Policy Statement, clearly indicated the necessity for an approach to planning that could encompass a wide array of technical, social and political issues. Transportation and land use were particularly interrelated within the Study Corridor, necessitating careful distinction between direct effects of the Project and changes due to incentive or indirect circumstances. The relations between Project proposals and the specific objectives of each local community demanded constant attention and discussion. In short, highway and transit planning in the nation's largest urban center required a broad scope of analysis and continuous public interchange.

Critical to this planning approach was the concept of the "program package." Simply stated, the program package was devised as a way to integrate all planning problems so that they could be studied and formulated into comprehensive workable alternatives. Each program package was made up of a plan for a highway facility, related proposals for public transportation, a description of the land use proposals and projected changes associated with these transportation plans, and a description of the financial, legal and administrative mechanisms which could bring the diverse components of each program package into reality. The program package concept also required an interdisciplinary staff of planners, architects, engineers, lawyers and economists, with the mandate to merge technical expertise with both local and regional priorities.

The staff was organized into Local Area Planning and Design Teams, whose geographic areas of concern corresponded to the boundaries of the Community Planning Districts within the Study Corridor. Guided by initial studies of physical constraints, local

Local area design teams combined community objectives with planning options.

conditions and trends, and by the goals and objectives developed by the participating Community Boards, each team formulated a series of preliminary alternatives for its District. Each team also consulted directly with City agencies, special interest groups and local community representatives, so that proposals could be modified to reflect specific community desires. As the number of alternatives narrowed, and the content of specific program packages expanded, the work of each team was supplemented by special staff investigations and analyses, reflected in a series of reports and technical studies.

The Community Boards in the Study Corridor either were represented by their own private planning consultants, or had their own planning expertise, thus expanding the dimensions of public participation to include community advocacy. Community Boards Two, Seven and Nine joined together to form a group called Combo, and hired their own consultant to interact with the Project. The critique by Combo's consultant of some assumptions underlying the Project's original growth projections and traffic forecasts led to revision of this work by the Project. Community Boards Four and Twelve each hired independent consultants, while Board One relied on the special technical capabilities of individual members of its Transportation Committee, and consultants to the Lower Manhattan business community. Continuous discussions among the West Side Community Boards, their consultants, and Project staff helped to clarify the basic objectives of the participating Community Boards, and their objections to particular Project proposals, as well as providing meaningful periodic outside evaluations of the Project work efforts.

Locations for a replacement highway facility were first examined at the local level, due to the close relationships between a new highway and the future of adjacent communities and the waterfront. This effort included a preliminary feasibility study of possible facilities north of 42nd Street, outside the Project Study Corridor to the north. At the same time, the Manhattan West Side Corridor Transit Study maintained a regional scope, focusing on a service area which included northern Manhattan, the western portion of the Bronx, and parts of Brooklyn, Staten Island, Westchester and the suburban counties of northern New Jersey. Since the overriding aim of the transit study was to provide for future increases in commuter trips to Manhattan, diverting some current auto trips to public transit, highway and transit work were closely coordinated. The staffs of both the highway and transit studies shared the same offices and utilized jointly the technical information produced by special consultants and public agencies.

In addition to direct discussions, presentations and exchanges of information between Community Boards, their consultants and Project staff, both highway and transit planning were conducted within the framework of an organized Community Liaison Program. This program was designed to maintain regular contacts with special groups affected by all aspects of the Project, and to involve them in the consideration of alternative plans. A Public Information Program was also active in making all information regarding the Project available to interested persons and groups. An open file was maintained throughout, so that all basic documents, work programs, progress reports, memoranda, records of community meetings and other material related to the Project's administration, planning and design work were continuously subject to public scrutiny.

Preliminary Alternatives

The development of alternatives began with the consideration of 17 possible locations for a new transportation facility between West Street and the pierhead line. These preliminary or sketch alternatives were generated by each of the three design teams after preliminary analysis of community goals, physical constraints and preliminary social, economic, environmental and engineering considerations. Unlike the five corridor-length alternatives described later in this document, these initial sketch alternatives were not continuous throughout the length of the Study Corridor. They were different for each Planning District area, placing primary emphasis on the relationship of each location to local issues and community concerns. In cross-section, the sketch alternatives were clustered in three horizontal locations—near the pierhead line, at the bulkhead, and in the right-of-way of the existing West Side Highway, spanning a vertical distance of between 120 feet below the surface and 60 feet above. Even options that seemed immediately unworkable were included at this point in the study, as well as the alternative of maintaining the existing West Side Highway.

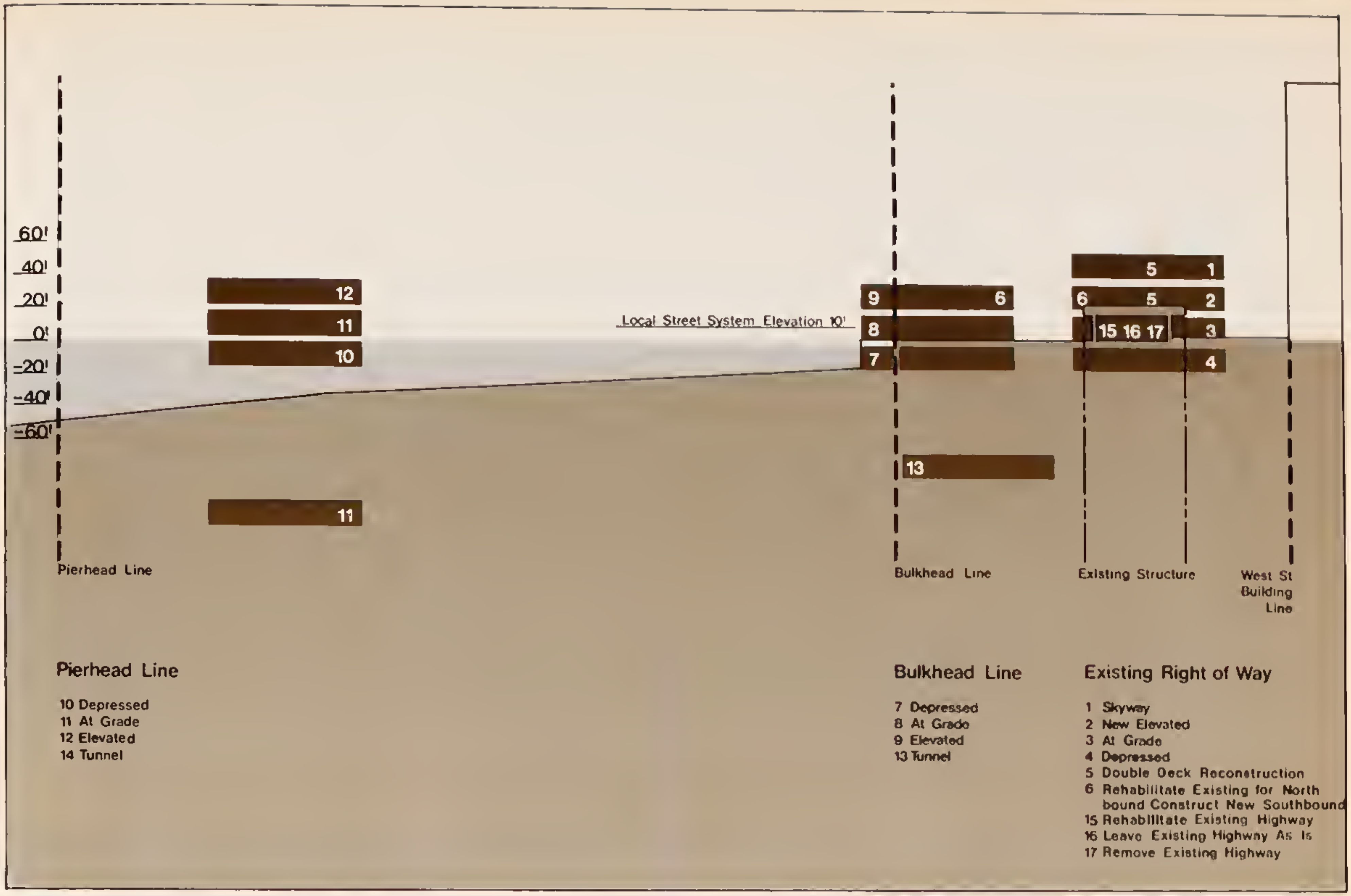


Illustration 39 Theoretical Locations for Initial Sketch Alternatives

The type and location of prospective alternatives which were not eligible under the Interstate System were also defined at this stage of the Project. These four additional possibilities were based on local community, legal and administrative criteria, and identified as follows

- Maintenance of the existing West Side Highway.
- Reconstruction of the existing West Side Highway in accord with current engineering, operational and safety standards.
- Removal of the existing West Side Highway and reconstruction of West Street-Twelfth Avenue, including a new public transit facility
- Removal of the existing West Side Highway and reconstruction of West Street-Twelfth Avenue without any public transit facility.

These four alternatives would be located in the combined rights-of-way of West Street-Twelfth Avenue and the existing West Side Highway.

Several forms of new public transportation technology were assessed on a preliminary basis, such as recently developed personal rapid transit ("PRT") systems. However, no new technology concepts were carried into detailed planning because none was found which could provide the capacity required for this dense urban corridor, nor could they provide a level of service competitive with the best technology of present private and public mass transportation. This conclusion subsequently was concurred in by the independent consultants employed by the West Side Community Boards

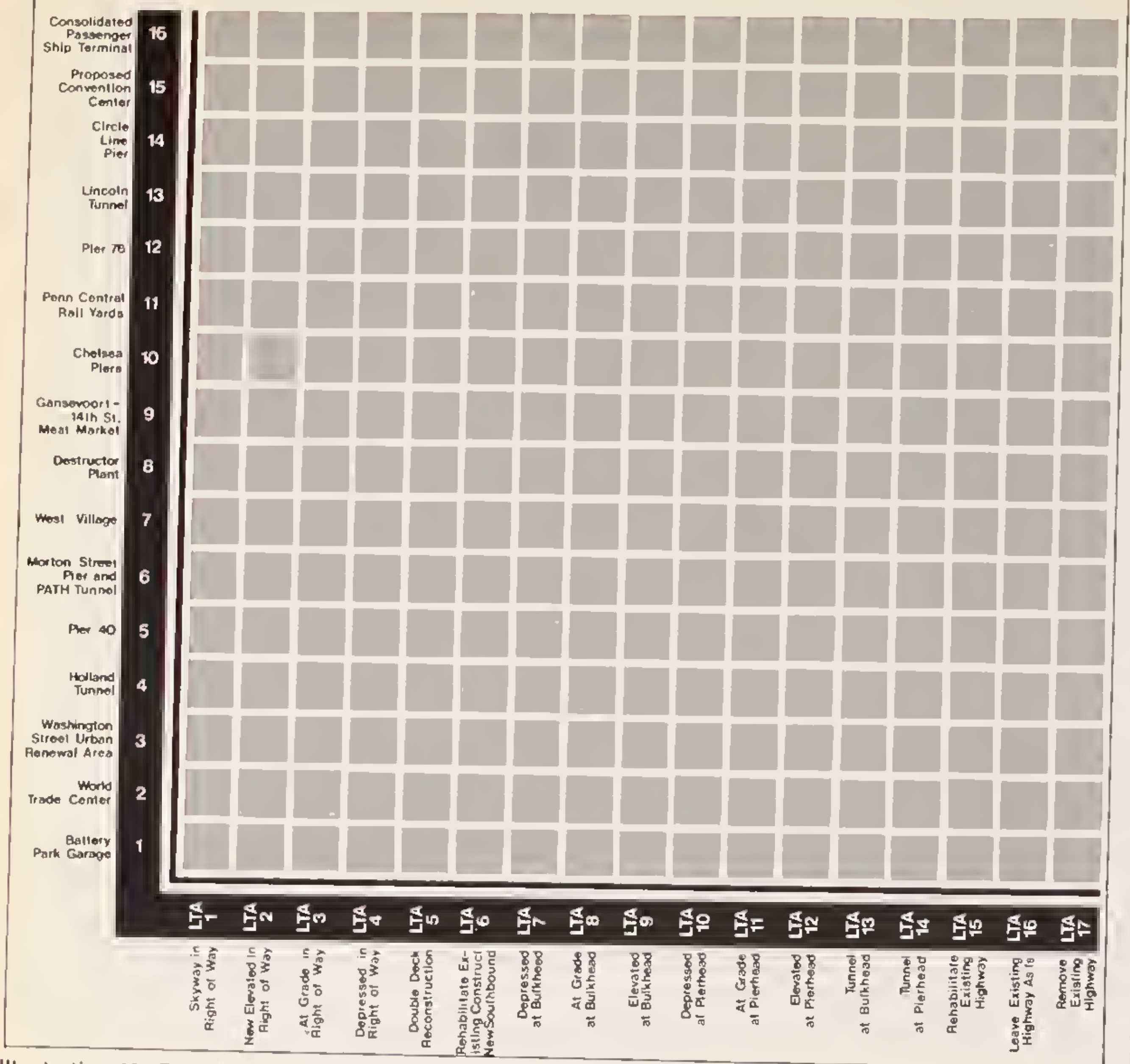

Consolidated Passenger Ship Terminal 16
Proposed Convention Center 15
Circle Line Pier 14
Lincoln Tunnel 13
Pier 76 12
Penn Central Rail Yards 11
Chelsea Piers 10
Gansevoort - 14th St. Meat Market 9
Destructor Plant 8
West Village 7
Morton Street Pier and PATH Tunnel 6
Pier 40 5
Holland Tunnel 4
Washington Street Urban Renewal Area 3
World Trade Center 2
Battery Park Garage 1
LTA 1 Skyway in Right of Way
LTA 2 New Elevated in Right of Way
LTA 3 At Grade in Right of Way
LTA 4 Depressed in Right of Way
LTA 5 Double Deck Reconstruction
LTA 6 Rehabilitate Existing Construct New Southbound
LTA 7 Depressed at Bulkhead
LTA 8 At Grade at Bulkhead
LTA 9 Elevated at Bulkhead
LTA 10 Depressed at Pierhead
LTA 11 At Grade at Pierhead
LTA 12 Elevated at Pierhead
LTA 13 Tunnel at Bulkhead
LTA 14 Tunnel at Pierhead
LTA 15 Rehabilitate Existing Highway
LTA 16 Leave Existing Highway As Is
LTA 17 Remove Existing Highway

Illustration 40 Evaluation Matrix for Initial Sketch Alternatives

A matrix is useful to demonstrate the process of determining the preliminary feasibility of each sketch alternative, in terms of the needs of adjacent communities and major physical constraints. The existing major facilities and important activities in adjacent Community Planning District areas, along with social, economic, environmental and engineering considerations, were used as the key criteria. As a result of this preliminary evaluation, each design team eliminated unfeasible sketch alternatives in its area. Several of the most significant possibilities that were removed from further consideration are the following:

■ **Skyway** A 60-foot high elevated facility in the present right-of-way, approximately 30 feet higher than the existing West Side Highway, was considered. This proposal was eliminated for Lower Manhattan because of severe engineering and traffic problems resulting from long ramp connections to the Brooklyn-Battery Tunnel and difficult access to the local street system. Substantial disruption to business and residential property would be required, and the proposal would physically conflict with City plans to provide elevated pedestrian walkways between Battery Park and upland areas. In other areas, a skyway would allow for continued vehicular and pedestrian access to the waterfront, but would hinder potential residential development or redevelopment of adjacent areas. The scale of such a structure would be grossly out of proportion with existing communities, casting a large shadow and creating a psychological barrier to the River. Noise pollution would be encountered by present and future adjacent buildings no higher than a skyway throughout the Study Corridor. From an engineering standpoint, the additional height and resulting cost increases of a skyway would not be justified. The vertical geometry of such a facility would also preclude a feasible connection to the existing Highway at or above 42nd Street, and would create excessively long and steep ramp conections to the Hudson River tunnels.

■ **Double Deck** An elevated facility in the existing right-of-way with single direction roadbeds at 30 and 60 feet above the surface was considered. This proposal was similar to the skyway and exhibited even more pronounced negative aesthetic and engineering characteristics. Ramping down from the top deck of this structure to a tunnel connection at five percent grade would requre excessively long distances of between 1,500 and 2,000 feet. A double deck structure would also present the worst visual barrier of any alternative, a consideration of ulmost importance to the goals and objectives of adjacent communities.

■ **Deep Tunnel** Deep tunnel facilities in land at the bulkhead line, and in water near the pierhead line, were eliminated because of extreme engineering difficulties, the necessity to build underground interchange connections, excessively long and disruptive access ramps to the local street system, and very high cost. Although land-use objections to these proposals were minimal, the necessity to pass under existing PATH, Holland, Lincoln, and Penn Central Tunnels at a depth of approximately 120 feet was prohibitive. A shield-driven tunnel at this depth and over 150 feet wide was considered unfeasible.

During the next phase of the Project, preliminary or potential locations that remained after this initial examination, generally three to four in each Community Planning District, were then connected to one another and developed into preliminary program packages. Essentially, the remaining sketch alternatives were joined by means of transitions in the vicinities of Canal Street and 14th Street, forming eight corridor-length alternatives for new highway and transit facilities. These eight sketch alternatives represented various combinations of depressed, at-grade and elevated structures, utilizing one or parts of all three basic rights-of-way.

■ **Inboard** The existing right-of-way.

■ **Midboard** Approximately half-way between the bulkhead and pierhead lines.

■ **Outboard** Near the pierhead line.

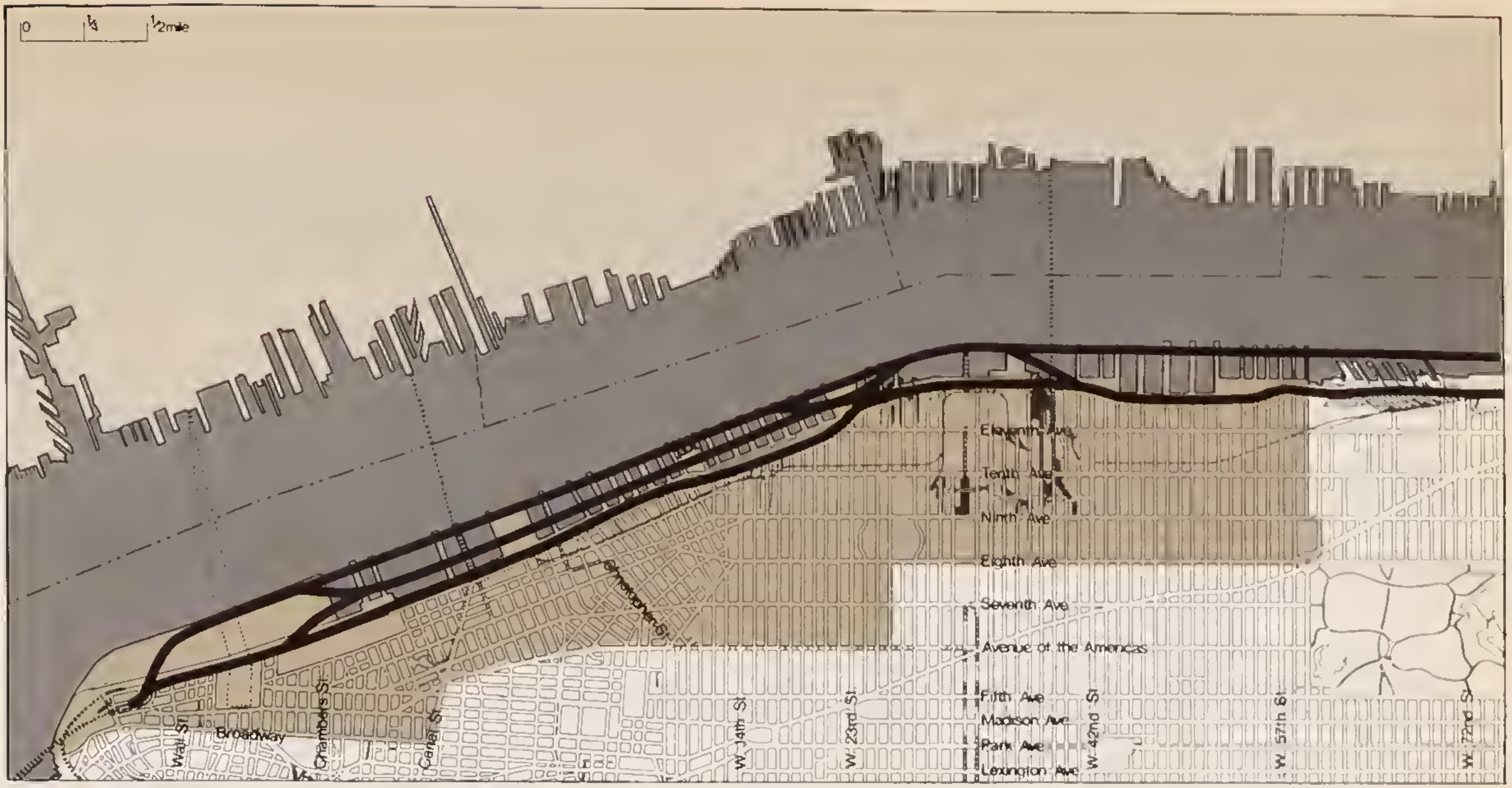


Illustration 41 Corridor-Length Sketch Alternatives

▨ Project Study Corridor

North

Development of Program Packages

Formulating program packages, the primary planning and design stage of the Project, consisted of integrating the eight corridor-length sketch alternatives and four non-interstate alternatives with locally-oriented land-use proposals, and public transit options attuned to regional travel requirements.

In terms of land use, the Project planning staff made three preliminary projections of patterns that might prevail within the Study Corridor by 1995—a 20 to 25 year planning period. Described as the **Minimum**, **Moderate** and **Maximum** assumptions, they were estimates of the amount of change in land use that different levels of economic and population growth might produce[56]. As such, they set a framework for understanding the dynamics of change within the Study Corridor over the years, and established the basis for making rough estimates of future volumes of the movement of people and goods. Because the Maximum projection called for a rate of growth higher than has been achieved in Manhattan in recent decades, it was deemed unrealistic by the City Planning Department and the Working and Steering Committees, and subsequently was eliminated from further Project planning work. Continuing with the Minimum and Moderate projections, the effect of each transportation facility on future land-use patterns in each community was analyzed.

The staff also conducted a preliminary investigation of existing land-use conditions and their relation to each alternative. For example, the plans and conditions created by Battery Park City, the World Trade Center and the Greenwich Special District, as well as existing and potential development in the Washington Street Urban Renewal Area and Holland Tunnel area were closely analyzed in developing program packages. In Greenwich Village, a preliminary scheme for rebuilding Pier 40 was developed and the potential impacts on such facilities as the Morton Street recreational pier, the Gansevoort Meat Market, and the Ganesvoort Destructor complex were tentatively established. Similarly, land uses and facilities along the Chelsea waterfront, especially the reuse potential for the Chelsea Piers, were closely scrutinized. A series of preliminary socio-economic studies which profiled existing activities like the printing industry, parking and important land-use trends throughout the Study Corridor were also used extensively in formulating each program package. In addition, the Project staff solicited the advice of City and State agencies and academic experts with regard to possible archeological effects of the various alternatives.

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[56] **Forecasting Methodology and Resulting Floor Area and Demographic Estimates for Use in Traffic Assignment Process.** West Side Highway Project Report No. 5.11, February 1973.

At the same time, work on the Manhattan West Side Corridor Transit Study had progressed to the point where five transit options were being examined in relation to the preliminary program package alternatives:

- Rail rapid transit (conventional subway).
- Express buses on an exclusive busway.
- New technology.
- Express buses on a limited busway.
- Buses operating in mixed traffic.

Studies were made of all transit options to determine their primary and secondary service areas, their flexibility for carrying different amounts of traffic and types of users. These studies resulted in a preliminary determination of system and operating characteristics for each option. Once the physical dimensions of the systems and the types of service they could provide were defined, specific transit options were matched with alternative highway alignments.

A formal evaluation of preliminary program package alternatives and transit proposals was conducted in October 1972, after review of these alternatives by the Project Steering Committee. This evaluation ended the initial phases of program package development, and included a special report which was distributed to the public—**Preliminary Analysis of Alternative Program Packages** (Report No. 5.01, October 1972). This report contained a description of each program package and an outline of the possible impacts of its components upon such factors as traffic, land use, community goals and the environment.

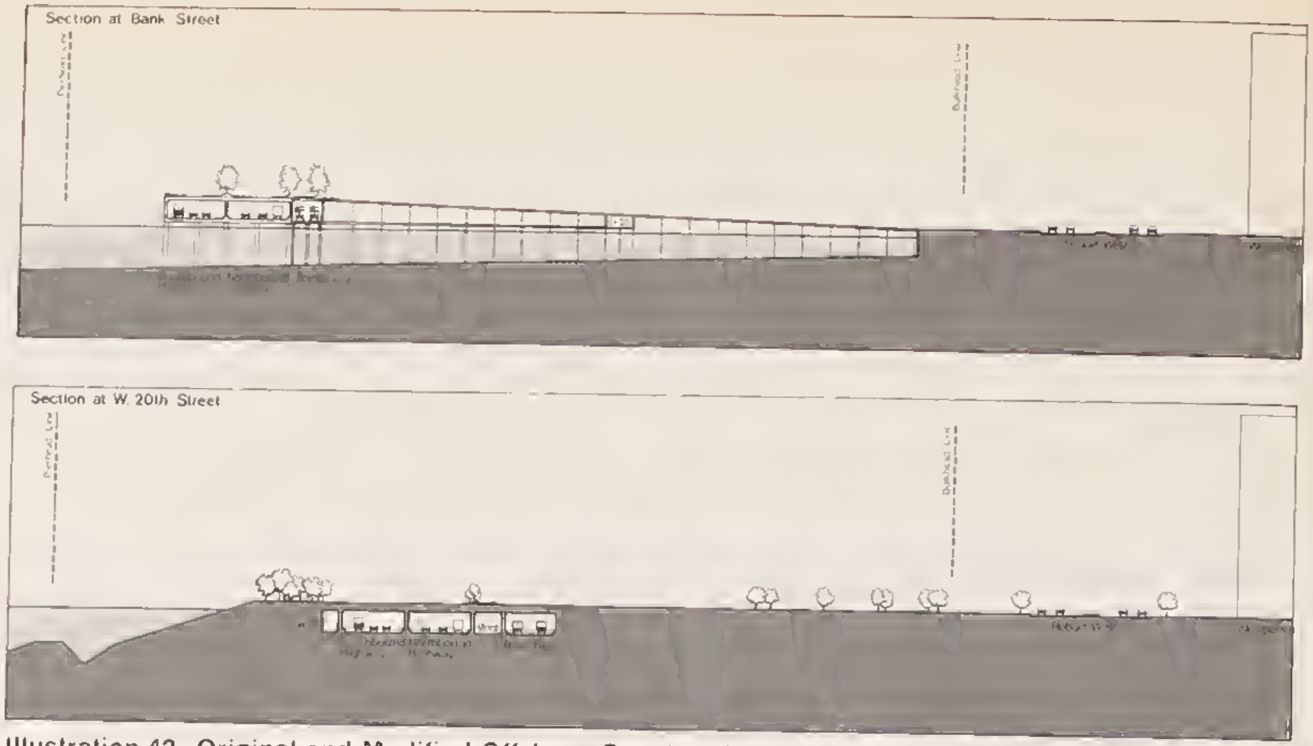


Illustration 42 Original and Modified Offshore Construction Techniques

Refinement of Program Packages
As a result of the preliminary evaluation and review by the Steering Committee, the preliminary program packages subsequently were further refined with particular attention given to a number of critical issues. Utilizing preliminary land-use and socio-economic analyses developed earlier in the Project, further, more detailed special studies were conducted. Project staff and consultants prepared comprehensive reports on maritime activities, railroad and trucking operations on the West Side, the Gansevoort Meat Market, the Gansevoort Destructor complex, and alternative schemes for Pier 40 and for the Chelsea Piers. Other reports were produced on parks and open space, and on landmarks and historic sites within the Study Corridor. And yet another set of studies focused on travel forecasting and transportation facilities, such as interchange areas. Each of these studies relied heavily on field research, personal interviews, and meetings and discussions with the appropriate community and special interest groups, in addition to the analytical work of Project staff and consultants.

A major engineering innovation was made in regard to the construction techniques proposed for the Project alternatives which would be located offshore, in what is now the part of the Hudson River occupied by the remaining West Side piers. As originally conceived, offshore alternatives would have been built on a pile-supported viaduct at the edge of the River, and covered with a 30-foot high platform sloping inland to the bulkhead. Such schemes would have created an area between the old bulkhead and the new water edge upon which new development might take place in the future.

However, this concept was rejected after more detailed analyses of implementation and aesthetics. A highway built at such an elevation, with an esplanade more than 20 feet higher than the existing elevation of West Street, would have interrupted visual access to the waterfront. Moreover, no assurance could be given that the deck connecting the highway with the old bulkhead would actually be built, thus creating an extensive area of land-locked water for an unknown period with uncertain environmental effects. In order to avoid such problems, an alternative form of construction was devised in which the highway and transit facilities could be depressed in landfill, thereby necessitating the creation of new land continuously between the old bulkhead and the new water edge.

Public transit options were also refined and coordinated with proposed highway alternatives during this period. The overall objectives of the transit studies were to accommodate future increases in regional travel on the West Side, and to discourage additional automobile commuting to Manhattan. Out of the initial range of five transit systems examined, two were found capable of meeting these objectives, depending upon the planning strategies and assumptions of each program package—express buses operating in a separate right-of-way, and conventional subway trains incorporating the best available technology.

In order to preserve both rail and express bus options for each of the appropriate alternatives, an exclusive transit facility, or "transitway," was conceived and designed. This transitway component for various program packages could accommodate either the rail or express bus system. A further flexibility of the transitway is that it would permit future conversion from one such transit system to the other. Thus, future changes in transit technology, in land use, or in travel demand could be accommodated by the transitway component. In this way, more than one transit option could be preserved for particular Project alternatives.

The rail transit option initially was matched with highway proposals utilizing the present rights-of-way of the existing West Side Highway and West Street-Twelfth Avenue. This conventional subway system would run from the vicinity of the World Trade Center to 240th Street in the Bronx. It would be located in a transitway beneath West Street from the World Trade Center to 23rd Street. From this point, the transitway would be constructed either beneath Eleventh Avenue to the 30th Street Railroad Yards, or under West Street-Twelfth Avenue to the 60th Street Railroad Yards. The transitway would then join the Penn Central rail right-of-way, running north under Riverside Park. At about 145th Street, the line would divide, with one branch following the Penn Central right-of-way north and the other going east to Mott Haven in the Bronx. This option assumes moderate levels of growth within the Study Corridor by 1995, and provides for more rapid service between the subway system in northern Manhattan and parts of the Bronx, and the West Side in Midtown and Downtown.

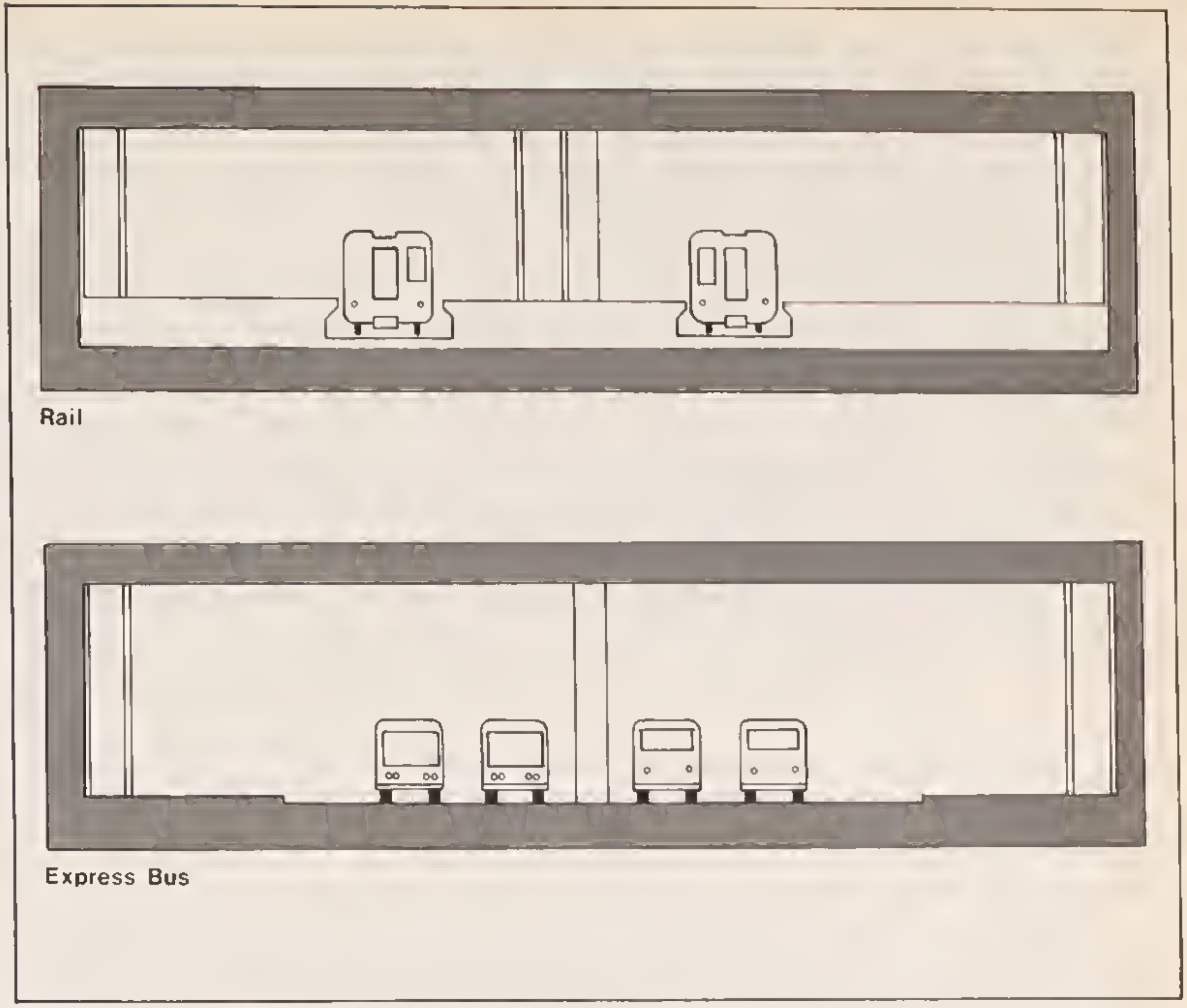


Illustration 43 Transitway Sections for Rail and Express Bus Systems

The rail transit service would make use of a version of this car

This is a production prototype of the vehicle proposed for express bus service

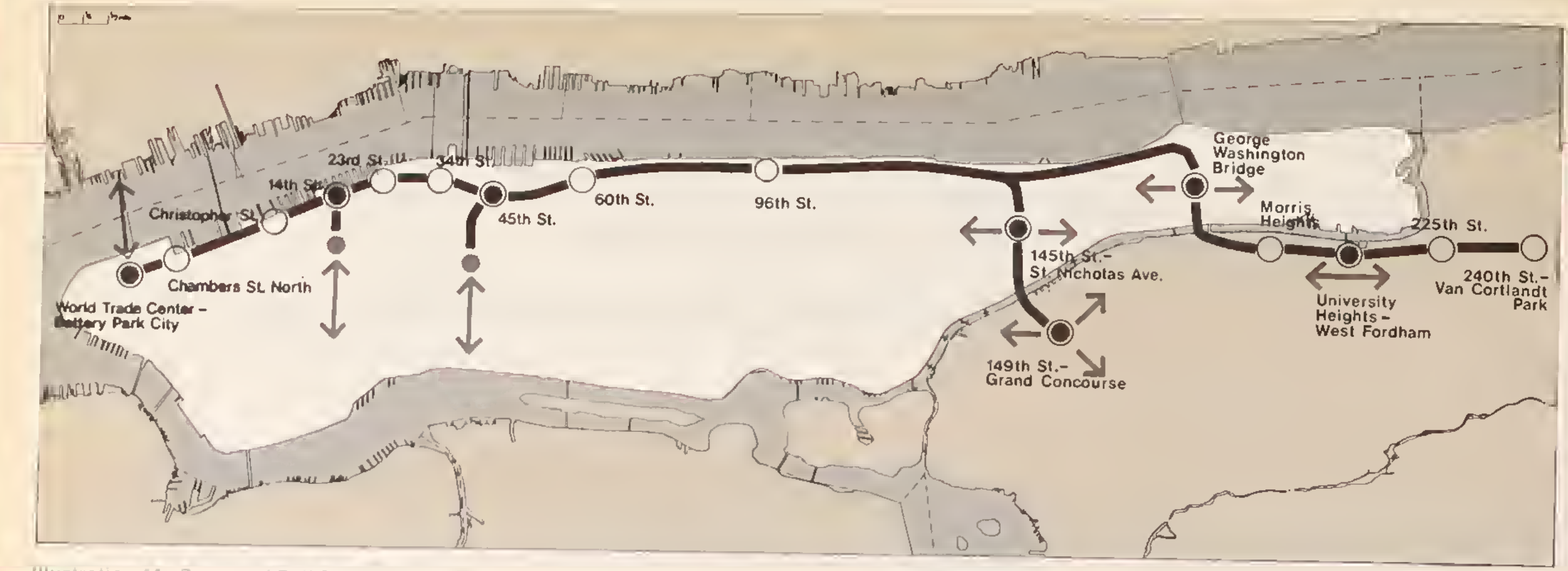

23rd St.
34th St.
14th St.
Christopher St.
45th St.
60th St.
96th St.
George Washington Bridge
Morris Heights
225th St.
Chambers St. North
World Trade Center – Battery Park City
145th St.– St. Nicholas Ave.
149th St.– Grand Concourse
University Heights – West Fordham
240th St.– Van Cortlandt Park

Illustration 44 Proposed Rail System

━ Proposed Route

→ Connecting Subway or Commuter Rail

○ Proposed Station

◉ Proposed Transfer Station

North

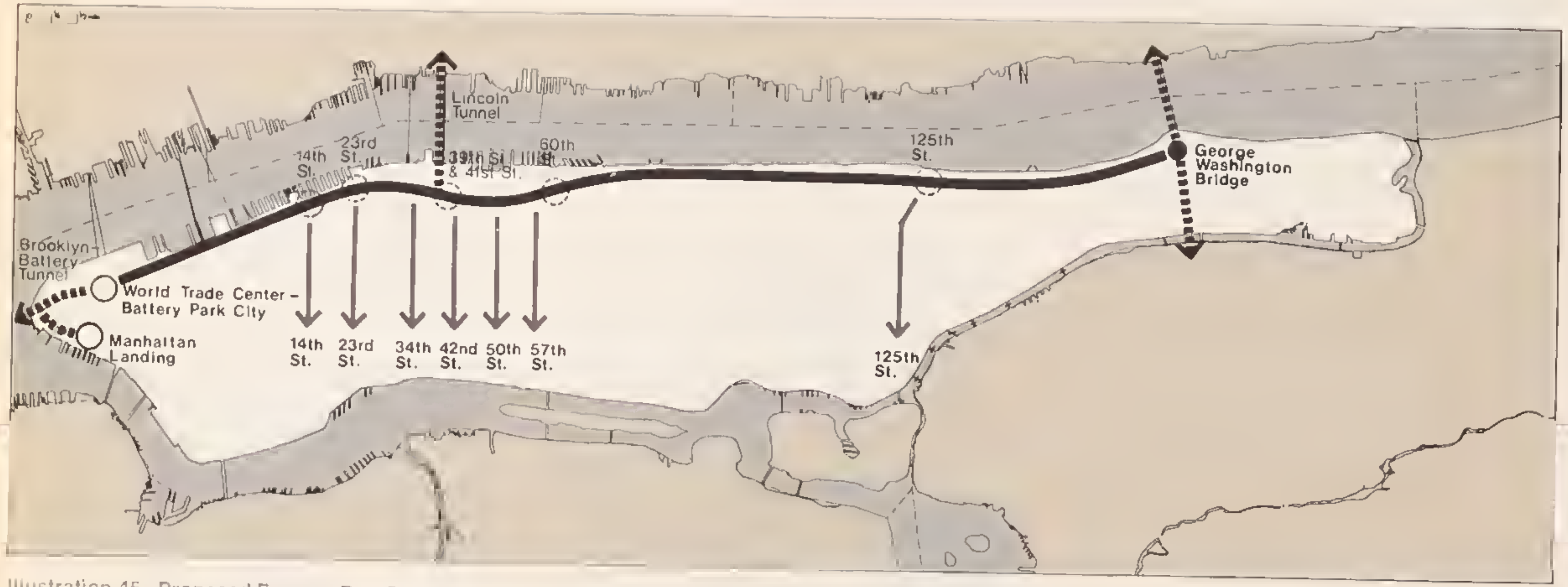


Illustration 45 Proposed Express Bus System

━ Proposed Route

→ Proposed Circulation Points

┅> Express Buses In Mixed Traffic

○ Proposed Station

● Existing Station

Access Point to Transitway

North

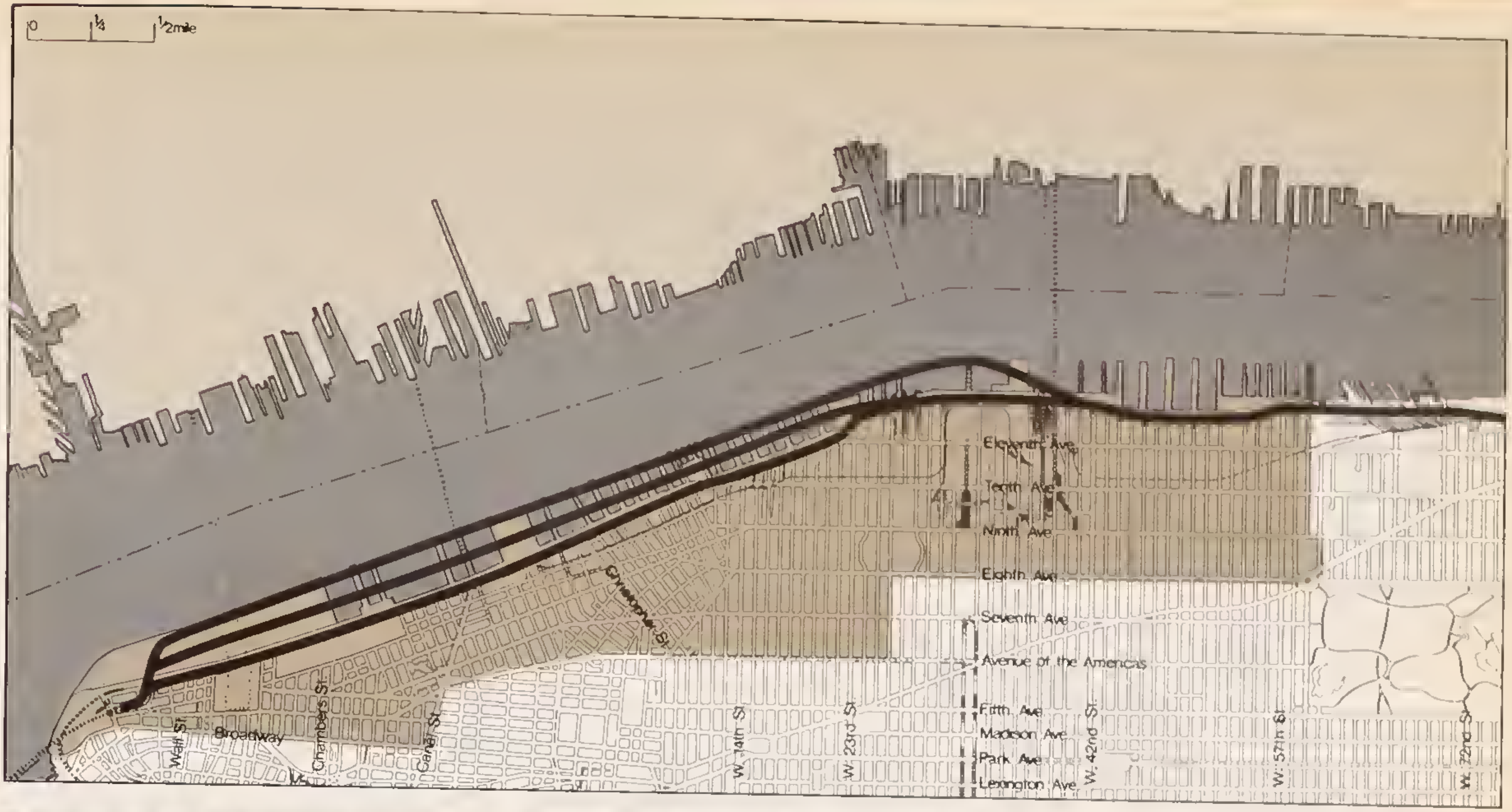


Illustration 46 Inboard, Midboard and Outboard Locations

▨	Project Study Corridor
◔	North

The express bus transit system was proposed as an exclusive bus facility in a transitway adjacent to a new highway below 23rd Street. Between 23rd Street and the George Washington Bridge, this express bus system would follow the same Penn Central right-of-way as the rail transit proposal, differing only in station locations and the provision of access ramps. Operationally, the express bus system was designed to coordinate crosstown circulation patterns in Manhattan with collection-distribution routes in the suburban commuter market areas. The concept of express buses on exclusive lanes is a relatively new public transit innovation which is currently experiencing wide ranging development and growth in several cities across the country, such as Washington, D.C., Seattle and Los Angeles. In New York City, express bus service already operates between the Manhattan Central Business District and surrounding boroughs. Express bus service across the Hudson into Manhattan from areas of New Jersey also exists, and the approaches to the Lincoln Tunnel, and a portion of the Long Island Expressway, operate with an exclusive bus lane during peak hours to handle some of this volume.

Throughout the refinement and specialized analysis phase of the Project, it became increasingly clear that several of the Interstate System program package alternatives had characteristics or effects that were very similar. For example, all alternatives except a replacement elevated highway in the existing right-of-way would require either the elimination or extensive reconstruction of the Chelsea Piers. In addition, it was also found that some of the transitions which permitted the connection of Inboard, Midboard or Outboard alternatives in various communities were unfeasible or did not contribute significantly to the attainment of the policies and objectives of the Project. Thus, transitions, or the connection of Inboard, Midboard and Outboard sections in different combinations were eliminated, and alternatives were merged into a manageable number to carry forward into detailed planning, engineering and social, economic and environmental analysis. This action focused attention on three primary Interstate System program package alternatives, one for each of the major locations—Inboard, Midboard and Outboard.

Non-interstate alternatives were carried through the same process of program package development and refinement as the interstates. Although study and analysis was conducted on all four such alternatives established early in the Project, three were carried into detailed planning evaluation. The fourth alternative, involving reconstructing West Street-Twelfth Avenue without a special transit facility, was not pursued in further detailed work. It was decided that it could be reinstated at any time as a matter of policy since all of the information would be available from other elements of the Project, in order to make a detailed analysis and assessment. As a result, the maintenance, reconstruction, and arterial with transit non-interstate proposals completed the range of six program package alternatives under consideration prior to final selection, evaluation and public review.

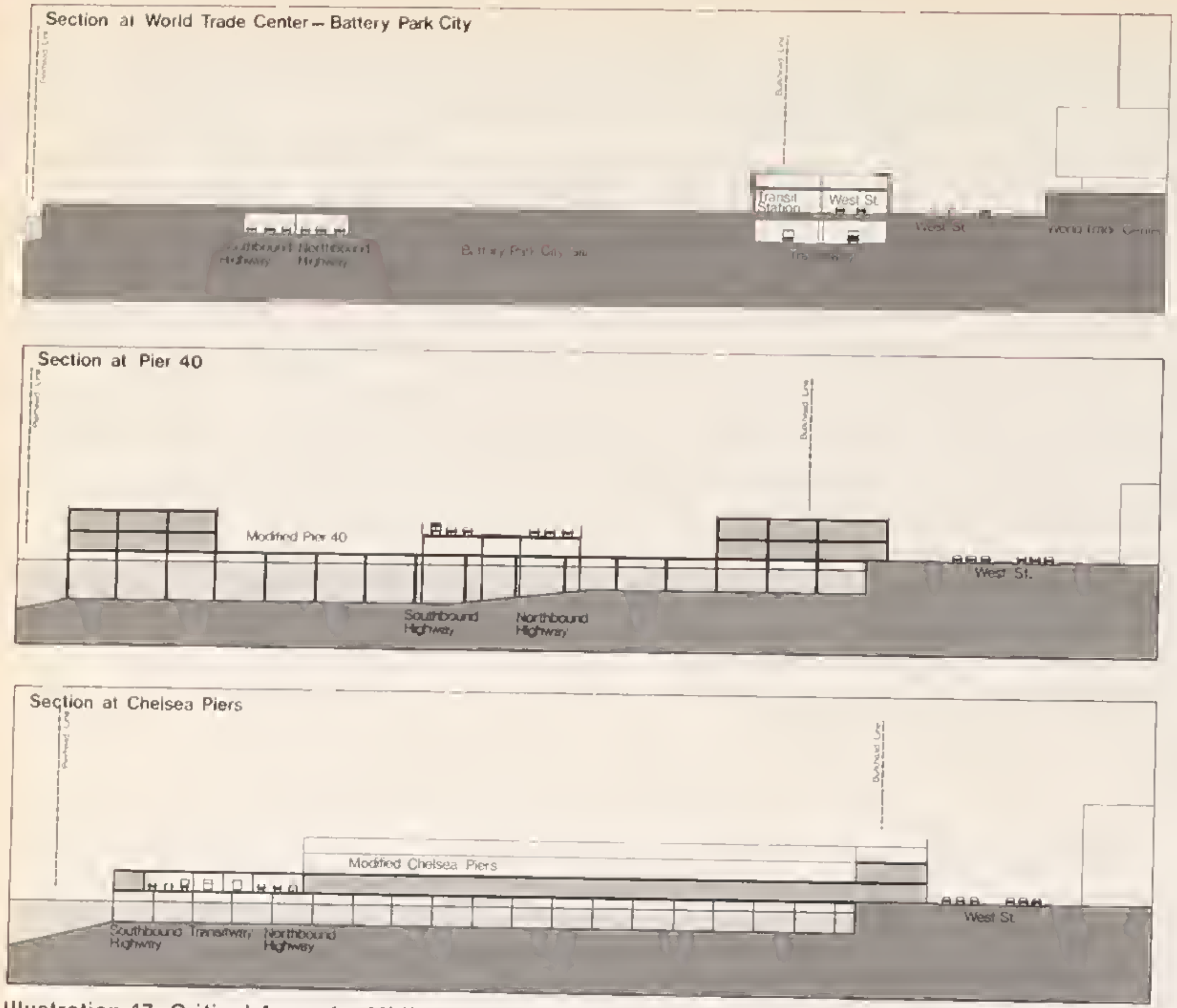


Illustration 47 Critical Areas for Midboard Alternative

Final Selection

During the final phases of the Project, three interstate and three non-interstate program packages had evolved through the planning process and various stages of review and refinement. While completing work on these six alternatives, the staff continued to make modifications which responded to particular problems, goals and objectives in light of the nature of current events. Some of this activity focused on corridor-length open space design, impact analysis and traffic considerations. Considerable effort was also devoted to a series of sub-options to the primary alternatives, such as alternative interchanges at the Holland and Lincoln Tunnels, and alternative rights-of-way for the proposed transitway north of 23rd Street.

A great deal of effort was spent addressing inherent problems of the Midboard alternative, resulting in its eventual elimination. Earlier in the Project, the Battery Park City Authority had requested that the feasibility of a Midboard depressed scheme passing near the center of the Battery Park City site be seriously investigated. This request precipitated a dialogue and exchange of information between the two offices which spanned many months. Project staff developed several architectural schemes reflecting the consequences of the Midboard alignment on the Battery Park City program, and alternative site plans were designed to accommodate these consequences. All studies were reviewed and discussed with representatives of the Authority on a regular basis, as well as with other public and private groups in Lower Manhattan.

A consensus was reached that the Midboard proposal was the most disruptive of all alignments under consideration in Lower Manhattan, and would preclude successful completion of the Battery Park City development. Specifically, the Midboard alternative would cause major conflicts between the two projects in the utilization of space, design, timing and phasing. This conclusion was concurred in by the Battery Park City Authority, the Transportation Committee of Community Board One, the Office of Lower Manhattan Development, and the Downtown Lower Manhattan Association.

North of Canal Street, at Pier 40, the Midboard alternative proved equally inappropriate. A detailed scheme for the rebuilding of Pier 40 to accommodate this alternative, at a cost of about $45 million, had been developed by Project staff. However, during a review of Project planning with the President and other officials of the International Longshoremen's Association, considerable doubt was expressed about the desirability and the effect of constructing and operating a highway through the middle of an active pier. Subsequent analysis of projected port activity, and a proposal by the Port Authority to relocate cruise ship operations to Midtown, diminished the advisability of such reconstruction. Studies showed that cargo activities at Pier 40 were waning, and that remaining cruise ship operations could be relocated to the new Consolidated Passenger Ship Terminal in Midtown at substantially lower cost than reconstructing the existing facility. Such relocation would also improve the operational characteristics of the new terminal by having all cruise ship activity in one place. Therefore, the cost of complicated alterations to Pier 40 necessitated by the Midboard alternative could not be justified.

The impact that the Midboard alternative would have on the Chelsea Piers presented additional evidence for its elimination. After meetings with local ILA unions and community groups, three alternative schemes were developed which would entail extensive rebuilding of the piers, while accommodating an offshore highway alignment. Each scheme would require substantial modification of the piers and would provide for different types of marine cargo, such as quayside docking and "LASH" shipping, and air freight loading operations. Despite these possibilities, the cost of reconstruction—approximately $60 million, coupled with the uncertainties surrounding any future activity at the pier facilities, could not justify continued preservation of the piers with an offshore alignment. Thus, the Midboard alternative, having substantially the same ultimate impact on these piers as the Outboard, was discontinued in this area as a viable alternative.

Finally, it appeared that the Outboard alternative in Lower Manhattan would have serious negative effects upon the Battery Park City development similar to the Midboard alternative, in terms of space, design and timing. In order to preclude such problems, the Outboard alternative was modified by joining it to the Inboard alternative along the length of the Battery Park City site. The transition on the final Outboard alternative, from the area of the bulkhead to the area of the pierhead line, would occur just north of Battery Park City, in the vicinity of the proposed Holland Tunnel interchange, and would not affect the overall operation of either the highway or the transitway.

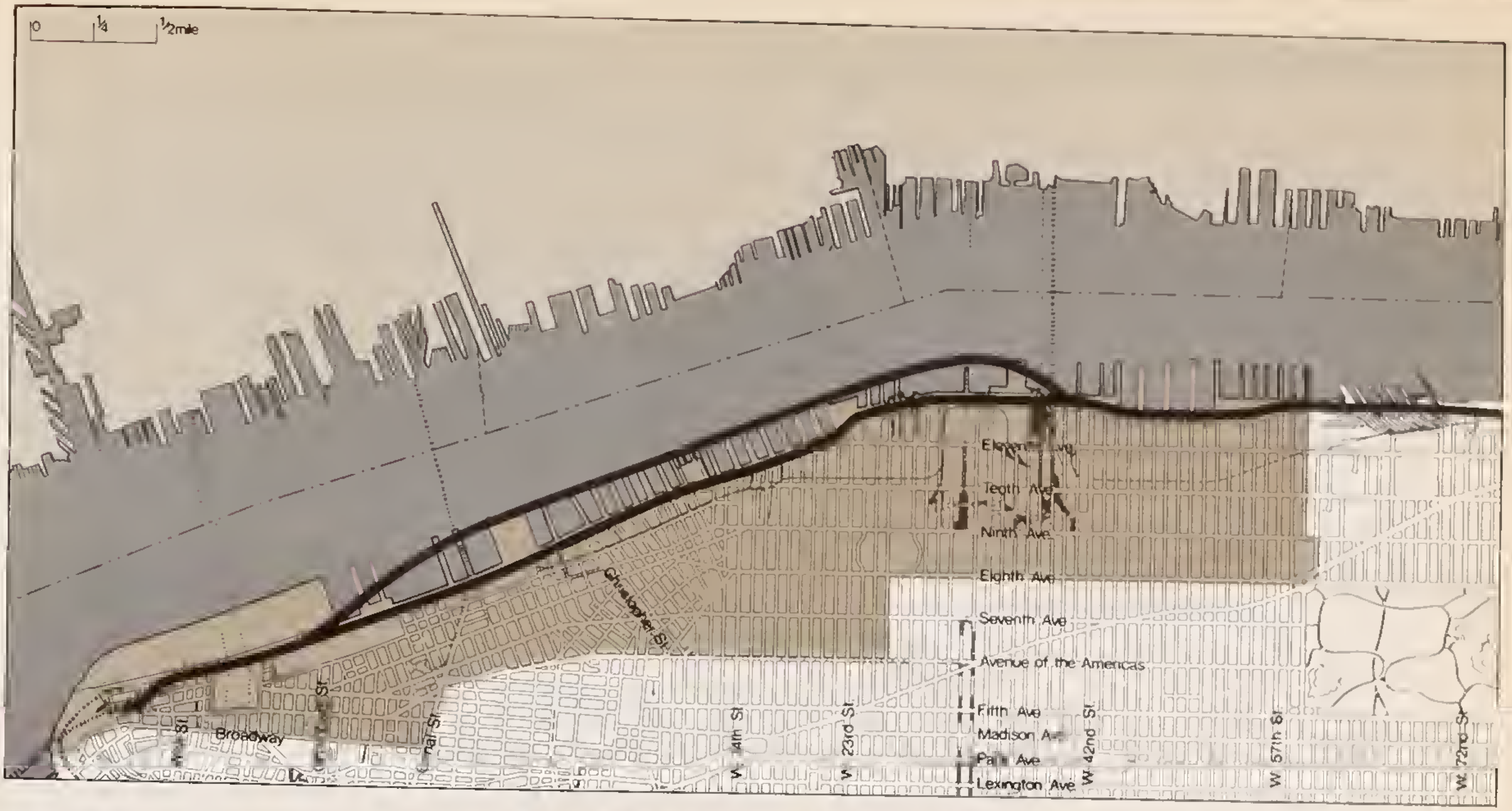


Illustration 48 Inboard and Outboard Locations

▨ Project Study Corridor

North

Thus, five program package alternatives, utilizing two basic transportation rights-of-way, were finalized and evaluated for presentation at public hearing:

■ **Maintenance** The existing West Side Highway would be repaired and maintained as an operating facility. This assumes preservation of existing Study Corridor facilities and little or no influence on the future growth or development of the West Side.

■ **Reconstruction** This would involve partial reconstruction of the existing West Side Highway in order to correct major structural deficiencies, making the road safer and permitting trucks to use the facility. It assumes preservation of existing Study Corridor facilities and little or no influence on the future growth or development of the West Side.

■ **Arterial** This would entail tearing down the existing West Side Highway, and replacing it with an at-grade arterial roadway of lower traffic capacity, and a depressed public transitway facility. It assumes preservation of existing Study Corridor facilities. It further assumes moderate stimulation of current redevelopment trends on the West Side, with future growth concentrated in relation to key elements of the transportation proposal.

■ **Inboard** This also would entail tearing down the existing West Side Highway, but would replace it with a six-lane interstate facility with a public transitway in the median. This assumes preservation of existing viable waterfront uses, minimal disruption of existing conditions, and some limited potential for net growth on the West Side.

■ **Outboard** This too would involve tearing down the existing West Side Highway. It would be replaced by a six-lane interstate facility constructed in landfill and covered in sections near the pierhead line, with an adjacent public transitway and a reconstructed West Street-Twelfth Avenue. It assumes that present waterfront facilities south of 42nd Street have no economic future, and that they should be displaced with landfill to accommodate new viable uses, primarily housing and recreation. It also assumes moderate levels of future growth and major economic revival of the West Side.

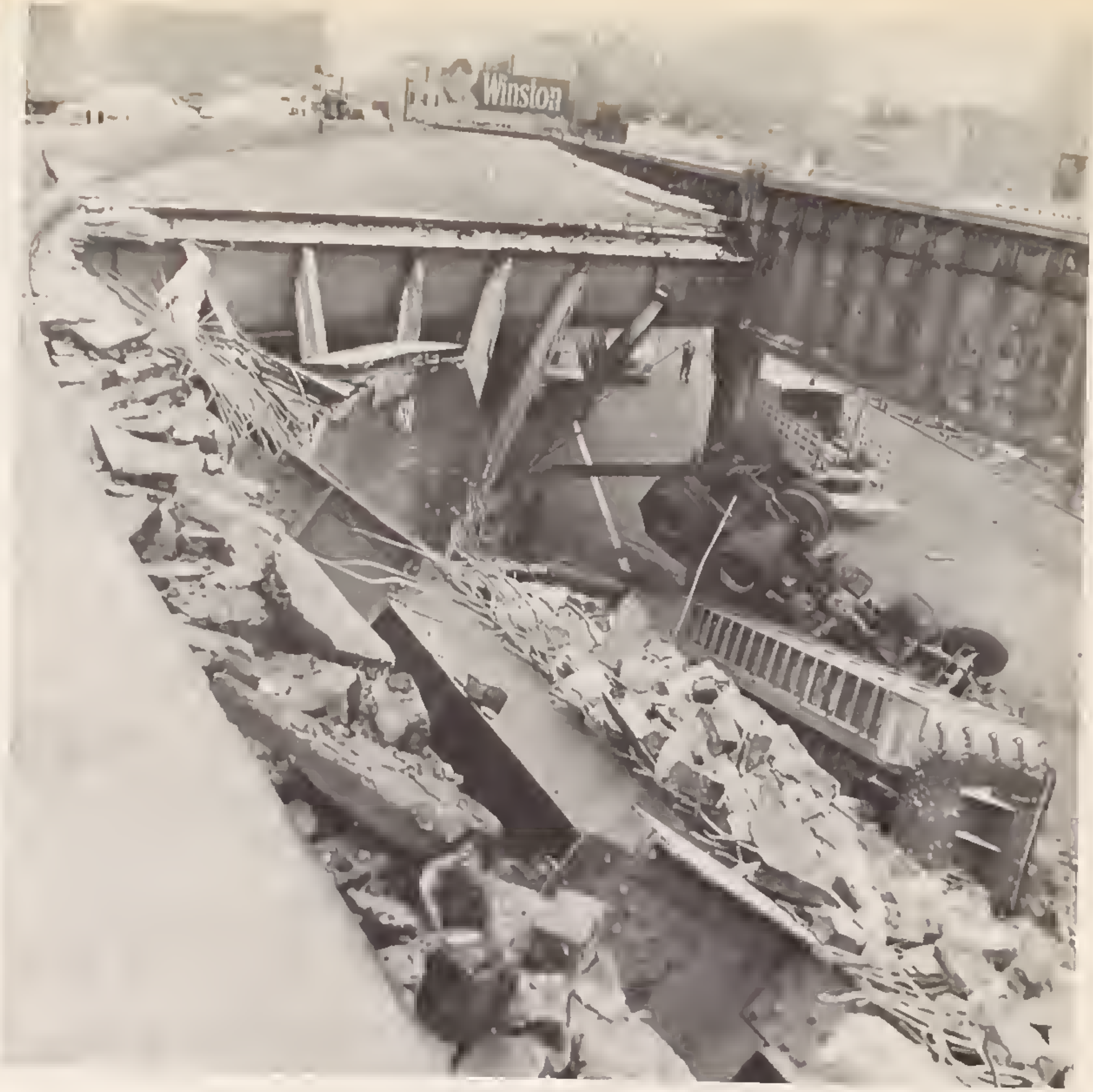
These five alternatives are described in the following pages against a background of rapidly changing circumstances. After a section of the existing West Side Highway collapsed in December 1973, additional structural deficiencies were detected throughout its length. Except for the section between 46th and 72nd Streets in Midtown, the Highway was subsequently closed for an indefinite period from 79th Street to the Battery. These circumstances have inevitably necessitated some alteration of specific components of each program package, notably implementation and financial aspects. Where such changes have been evaluated at this time, they are noted in the following description of alternatives, and are discussed in Section 4 of this report, dealing with the probable impacts of the alternatives.

Maintenance Alternative

Under this alternative, the existing West Side Highway would be repaired and reopened, and then serviced with continued periodic maintenance. Repairs and maintenance would be conducted in the area from the Brooklyn-Battery Tunnel in Lower Manhattan to 72nd Street, where the facility connects with the Henry Hudson Parkway. It should be noted that one or more sections of the Parkway north of 72nd Street also are seriously deteriorated, but there is no attempt in this document to describe such conditions or methods of maintenance beyond the limits of this Project.

Initially, the Maintenance alternative was conceived as a program of routine maintenance, conducted on a regular or continuous basis, in order to ensure the continued operation of the existing West Side Highway, which had been carrying traffic since the 1930's. That is, no action would be taken other than for the City to continue its normal maintenance of the existing West Side Highway for the next 20 to 25 years. Such maintenance would consist of routine repairs to the deck and supporting structure of the roadway between the Brooklyn-Battery Tunnel and 72nd Street. Such a maintenance program would keep the facility operating until 1995 in the condition and manner that it operated in 1972, at the outset of the Project.

However, during the period of the planning activities of this Project, the changing conditions of the existing West Side Highway required that the City close it down entirely south of 46th Street for an indefinite period. On December 15, 1973, just a few months before the completion of the Environmental Impact Statement, a whole section of the northbound elevated roadway near West 12th Street collapsed. This occurred while construction equipment was on the Highway to repair the deck in the area of 14th Street. This collapse, and subsequent structural inspection, resulted in the complete closing a short time later. In addition, sections of the existing highway to the north, beyond the boundaries of the Study Corridor, were also found to be structurally deficient and subsequently closed down.



Maintenance Alternative

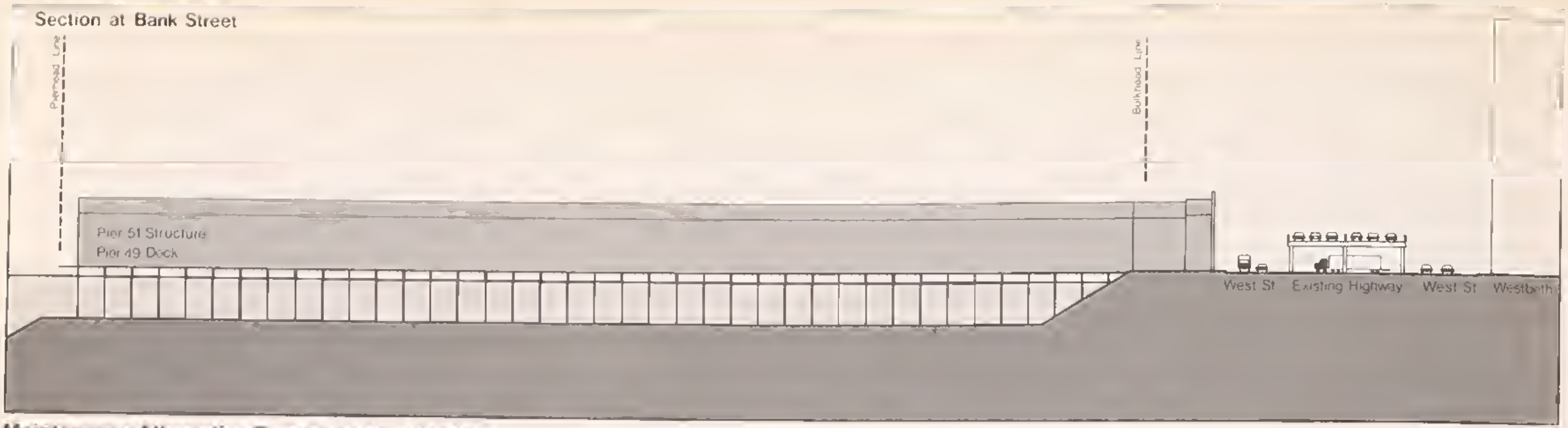
West Side Highway Project Maintenance Alternative

🟫 Existing Highway Facilities

🟩 Existing Public Park Lands

▨ Project Study Corridor

North



Maintenance Alternative Representative Section

In light of these unexpected and late developments within the Study Corridor, it became evident that the existing West Side Highway could be kept in operation between the Battery and Lincoln Tunnel only by first repairing the deficiencies. Thus, the Maintenance alternative had to be modified in order to incorporate the initial repair work which would have to be undertaken by the City. This work had become a prerequisite to continuation of routine maintenance until the design year of 1995.

First, the entire structure must be carefully inspected and its condition analyzed. Once the detailed physical condition of the highway is determined, decisions can then be made as to the scope of repair work necessary to put the closed section back into operation. This in-depth inspection and analysis by the City of New York is scheduled to start in the Spring of 1974, and is expected to continue beyond the time of the public hearing for the West Side Highway Project. Without the benefit of such information at present, the extent and nature of the specific repairs necessary to place the highway back in service and maintain it through 1995 cannot be known for certain. However, some assumptions can be made, based upon previous experience.

One relevant and recent situation provides guidance in this respect—the work done during 1973 on the southbound lanes of the West Side Highway near 14th Street. The concrete deck was removed, the structural steel repaired, the deck replaced, and new joints installed, along with a new pavement surface. Such efforts result in a structurally sound facility, but with no change or improvement in highway geometry or safety.

For the purposes of description of the Maintenance alternative, it is assumed that this type of work would be necessary on the section of highway from Canal Street north to 60th Street. The portion south of Canal Street is newer and currently in better condition. Repairs to the steel, joints and drainage system, along with painting, would be necessary for this part of the road. The section from 60th Street north to 72nd Street would also require somewhat less work at this time, because of extensive repairs made in recent years. However, it would be more difficult and costly to maintain this section, until 1995 and thereafter, than the section south of Canal Street, due to its greater elevation and age. After such immediate and extensive repairs were made, routine maintenance could then be resumed and the facility reopened to traffic.

In summary, the initial repairs contemplated for the highway would result in a structurally sound facility, capable of handling the same amount of automobile traffic that was accommodated prior to its closing in December of 1973. Trucks would still not be able to use the highway, and neither would the deficient curves and inadequate access ramps be improved. Past maintenance procedures, such as placing temporary steel plates over holes and temporary lane closings, would have to be continued into the future, based upon a long term repair schedule. No new public transit facility would be provided with this alternative. However, buses could continue to operate on West Street in mixed traffic.

Because none of the proposed improvements would significantly change the highway location, operation or configuration, the Maintenance alternative would not act as an incentive for change in adjacent areas. In fact, the negative aesthetic, structural and operational characteristics of the existing highway would continue as a disincentive for positive redevelopment forces on the West Side.

Reconstruction Alternative

The Reconstruction alternative provides for the rehabilitation and partial reconstruction of the existing West Side Highway between the Battery and 72nd Street, in order to correct major structural deficiencies, improve safety, and extend utilization of the facility to trucks and other commercial vehicles.

Rather than new transportation facilities, the Reconstruction alternative proposes specific modifications to the existing structure. These modifications would include new access ramps, the elimination of sharp curves, and the provision of safety shoulders which would remove some of the most dangerous features of the existing Highway. Reconstruction would also permit trucks to use the facility, thus diverting some heavy vehicles from local streets, in response to a major problem identified by local community groups While providing improved safety and operational benefits, this alternative would lower the absolute capacity of the highway by reducing the number of lanes from six to four from Rector Street to 57th Street No special transitway facility would be provided. However, the proposed improvements would permit buses to operate on the highway along with cars and trucks. The reconstruction of West Street-Twelfth Avenue would also allow for the improvement of local bus service.

In summary, the Reconstruction alternative would provide greatly improved operational characteristics over the existing West Side Highway, but would retain the same physical character of an elevated highway structure. Except in the areas where sharp curves would be eliminated, a reconstructed highway would occupy the same space as the existing West Side Highway No new right of way would be required, except for one ramp connecting the northbound roadway to Tenth Avenue at 18th Street

Program Package Components

The primary components of the program package for the Reconstruction alternative are briefly described below, and then explained in detail as they apply to each of the four West Side communities.

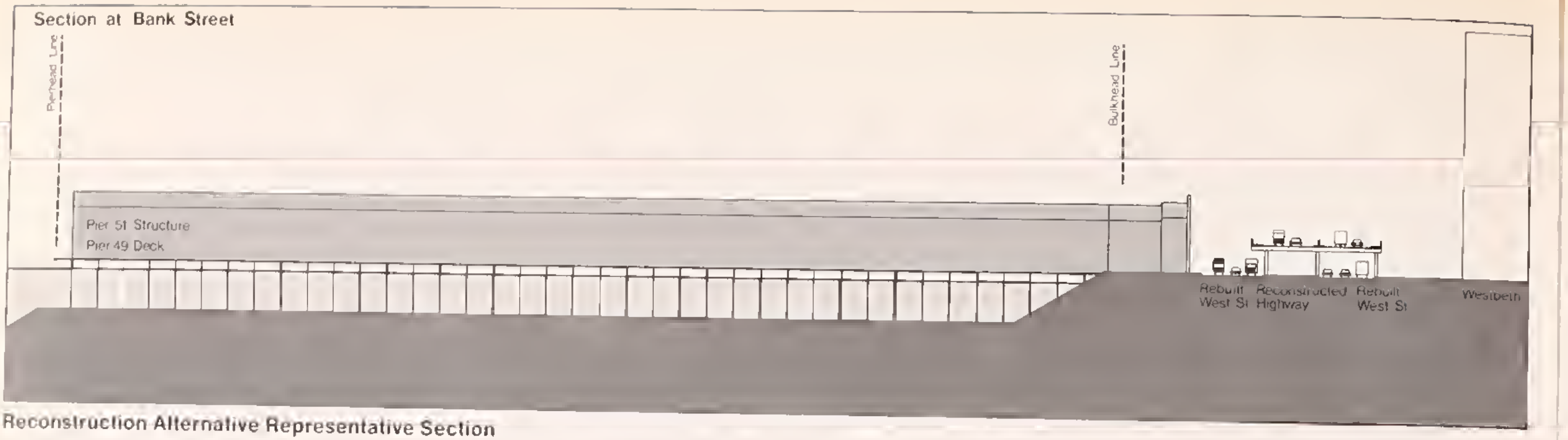
- Throughout its entire length, a new roadway surface would be provided for the mainline highway, to replace the existing crumbling and potholed surface. Other more significant improvements, such as alterations to the existing structure, total reconstruction, and new ramps would be included in various locations along the corridor The existing columns, foundations, girders and some steel structure would be retained in about 30 percent of the total length. The remaining 70 percent of the facility would be new construction.

- Beneath the elevated facility, West Street-Twelfth Avenue would also be reconstructed to provide three through traffic lanes in each direction, parking areas where feasible, and appropriate cross-street intersections with traffic signals.

Reconstruction Alternative

West Side Highway Project Reconstruction Alternative

▨	Existing Highway Facilities
🟫	Proposed Highway Facilities
🟩	Existing Public Park Lands
▦	Project Study Corridor
◔	North



Reconstruction Alternative Representative Section

Lower Manhattan
The section of the existing West Side Highway between Battery Place and Canal Street, completed in the early 1940's, was the last link of the original six-mile long facility to be built. As a result, this section has less deterioration and fewer structural weaknesses than other parts of the facility, and would require the least amount of alteration and reconstruction. South of Liberty Street, where the facility passes between the World Trade Center and Battery Park City and ends in ramps down to West Street, the Brooklyn-Battery Tunnel, and the Battery Park Underpass, only minor reconstruction and necessary roadbed repairs are proposed for the existing viaduct. Likewise, the existing arch bridge at Canal Street would require only minor deck modifications. Existing entrance and exit ramps near the Battery Park Garage and Rector Street would also be retained and unaltered. Only in the nine-block area between Warren Street and the Canal Street arch bridge, adjacent to the Tribeca warehousing district, would the highway be torn down and rebuilt to accommodate improved ramps which would permit both northbound and southbound traffic to enter and exit the highway at Chambers Street. In addition, a ramp would be constructed to permit northbound traffic to exit from the highway at Vestry Street, about three blocks south of Canal Street.

Greenwich Village
North of the Canal Street bridge to West Houston Street, adjacent to Pier 40, the existing highway viaduct would be torn down and reconstructed in order to accommodate new right-hand entrance and exit ramps at Canal and Spring Streets. The existing superstructure steel members would be reconstructed to provide a new and wider deck, capable of carrying two lanes of mixed traffic in each direction, with left and right safety shoulders, and speed change lanes for the new ramps.

At the northern end of the Village waterfront, the existing highway turns sharply between the Gansevoort Destructor complex and the Gansevoort-14th Street Meat Market, forming a sharp curve. In the Reconstruction alternative, the existing viaduct would be torn down between Horatio Street and West 13th Street, and rebuilt in a new alignment that would modify this curve

Chelsea and Clinton
Along the Chelsea waterfront adjacent to Piers 58 to 62, two major modifications are proposed. At 18th Street, an exit ramp from the northbound highway lanes to Tenth Avenue would be constructed. And between 23rd and 29th Streets, where the existing highway makes another sharp curve directly above Thomas F. Smith Park, the entire viaduct would be torn down. The proposed reconstruction would involve a new alignment to modify the curve to meet safety requirements. It would also provide for new exit and entrance ramps at 23rd Street to replace existing ramps adjacent to the Chelsea Piers.

From 29th Street to 42nd Street, adjacent to the Penn Central railroad yards, a new elevated highway would be constructed. The existing ramps at 42nd Street would also be reconstructed to provide southbound access ramps and safety lanes

From 42nd Street to 72nd Street, passing the proposed Convention Center and the new Consolidated Passenger Ship Terminal, major reconstruction of the facility would be required. Existing ramps located near 55th and 59th Streets would be replaced by a full interchange at 57th Street. Trucks would be allowed to use the reconstructed highway as far north as the new 57th Street interchange. In order to smooth the transition of traffic from the Henry Hudson Parkway at 72nd Street to the four lanes provided south of the proposed interchange, the remaining 15-block section of the highway north of 57th Street would be reconstructed with six lanes

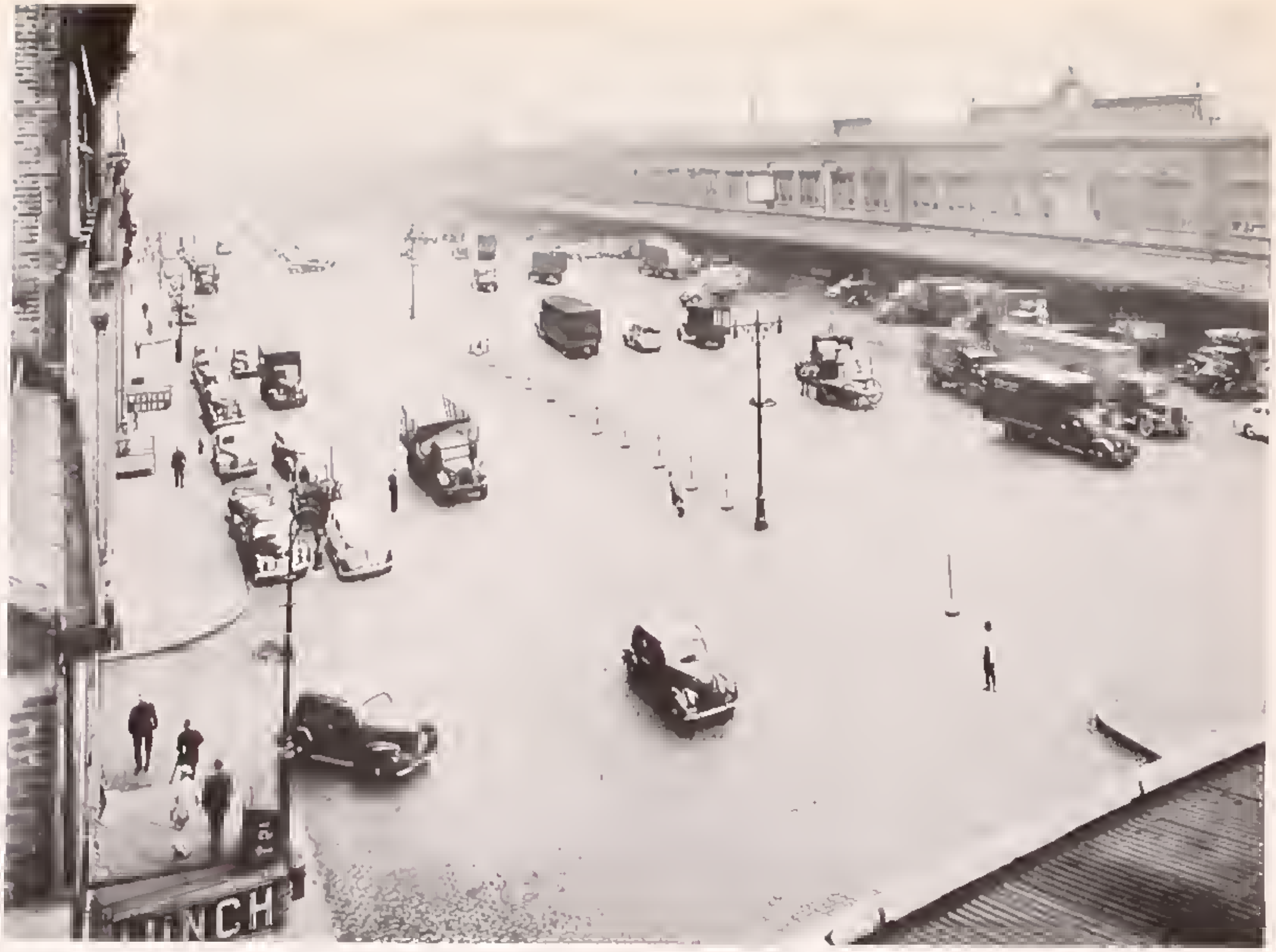
Arterial Alternative

The Arterial proposal contemplates the replacement of the existing West Side Highway with two new transportation facilities. These facilities would consist of an at-grade arterial street from Battery Place to 59th Street, and a depressed and covered transitway. Both facilities would be located largely within the right-of-way of the existing West Side Highway, commonly known as West Street-Twelfth Avenue and Marginal Street.

The most prominent feature of the Arterial alternative would be the demolition of the existing elevated highway. Except for the elimination of the existing structure, the waterfront and all riveredge facilities would remain as they are today. The proposed Arterial street would not create any additional land for development, recreation or open space. This facility would have a lower traffic capacity than the existing combination of the West Side Highway and West Street-Twelfth Avenue. Since it would not provide connections to all cross streets, a system of intermittent service roads is proposed to provide for traffic service to all existing West Side local streets. The transitway, which could be built either as a rail rapid transit line or an express busway, is illustrated here in its rail configuration. In summary, the Arterial with transit combination is an alternative which would preserve existing land-use conditions while providing new transportation facilities.

Program Package Components

The primary components of the Arterial alternative program package are briefly described below, and then explained in detail as they apply to each of the four West Side communities.



This photograph shows West Street south of Liberty Street on a summer morning in 1941, before the West Side Highway had been built in that area. Implementation of the Arterial alternative would result in the return to a similar relationship of the new surface thoroughfare to remaining pier facilities and upland areas in much of the Study Corridor.

■ The proposed Arterial street would be a continuous at-grade facility with three lanes in each direction, separated by a 10 to 20 foot median. Intermittent service roads parallel to the Arterial would also be provided at specific locations based on traffic forecasts and the temporary parking requirements of adjacent land uses. Eleven major intersections would be provided where local traffic, from either the service road or from local streets, could enter or exit the main Arterial lanes in both northbound and southbound directions.

■ The transitway would run beneath the Arterial from the World Trade Center to 23rd Street. Then it would follow a route under Eleventh Avenue to the 30th Street Penn Central rail yards, connecting to the existing railroad right-of-way through west Midtown and under Riverside Park. It also could continue under the new Arterial West Street-Twelfth Avenue, and join the Penn Central rail right-of-way in the 60th Street yards.

Arterial Alternative

West Side Highway Project Arterial Alternative

🟫 Proposed Highway Facilities

⬜ Proposed Transitway (Covered)

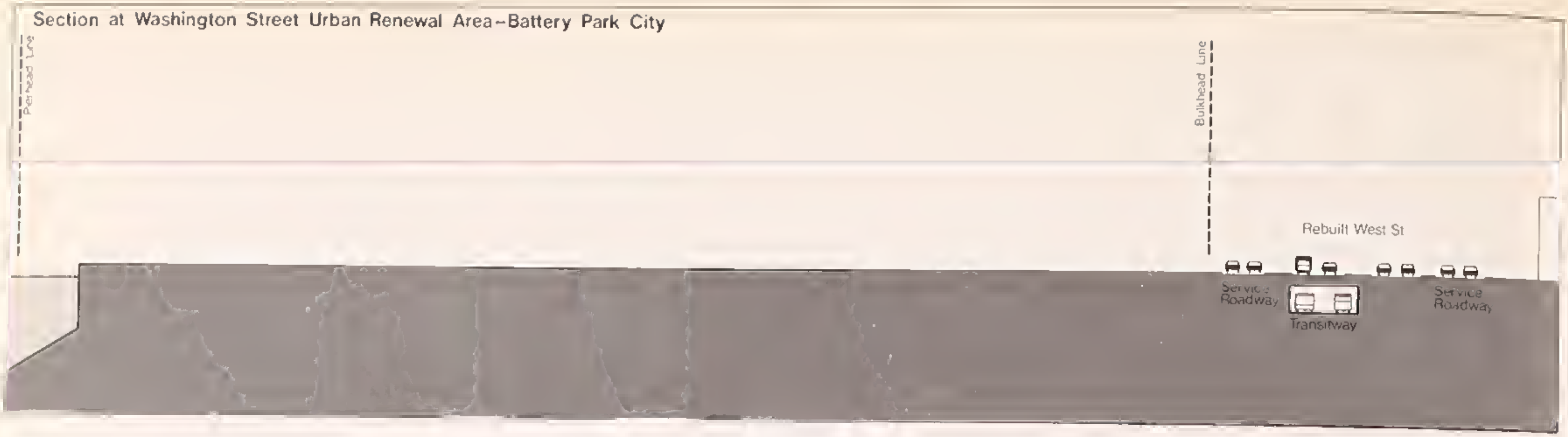
🟦 Proposed Transitway (Uncovered)

● Proposed Transit Station

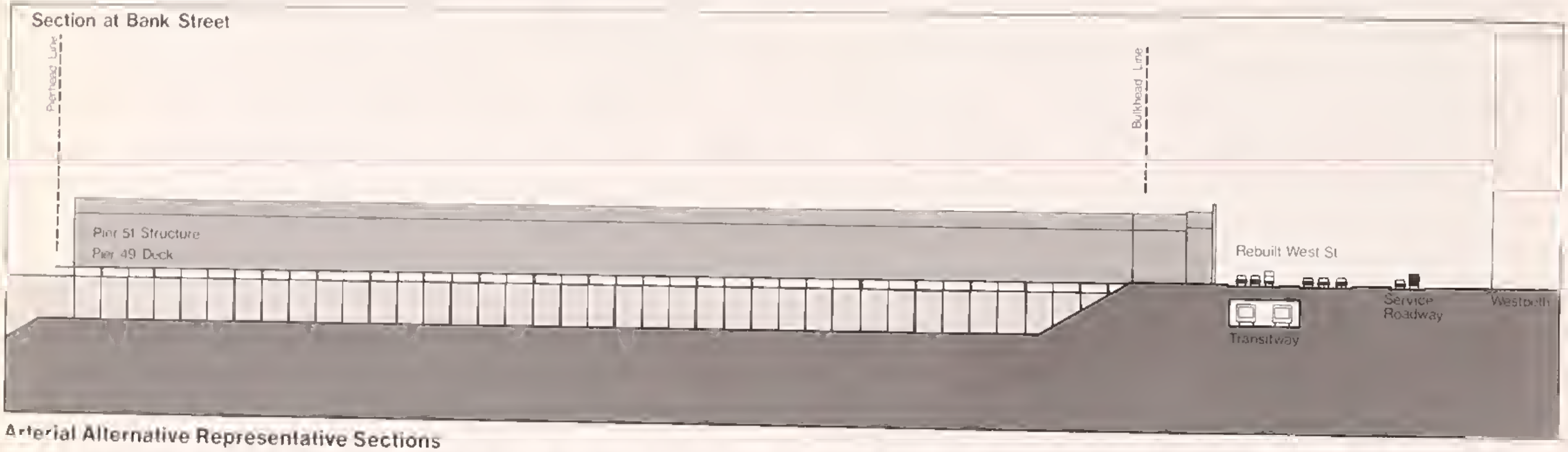
🟩 Existing Public Park Lands

▨ Project Study Corridor

North



Section at Washington Street Urban Renewal Area–Battery Park City



Section at Bank Street

Arterial Alternative Representative Sections

Lower Manhattan

South of Canal Street in Lower Manhattan, the Arterial alternative would consist of an at-grade six-lane street with parallel service roads and a depressed and covered transitway underneath the median with a station between Battery Park City and the World Trade Center. Starting at Battery Place, the Arterial would be a median-separated facility with three lanes of traffic in each direction. It would be intersected by major cross streets at Battery Place, Liberty, Vesey and Canal Streets, and have a grade-separated connection from the southbound lanes of the Arterial directly to the Brooklyn-Battery Tunnel. The existing grade-separated connections to and from the World Trade Center underground parking facilities and the north and southbound roadways would be maintained.

In order to provide vehicular access to Battery Park City and existing uses along the east side of West Street, parallel one-way service roads on each side of the Arterial lanes would be provided. These service roads would be 34 feet wide, and accommodate two lanes of traffic plus a parking lane. The service road along the west side of West Street would extend north only as far as the end of the Battery Park City property. The service road along the east side of West Street would continue north past the Washington Street Urban Renewal Area to Canal Street, in order to provide access for present and proposed development in that area.

The proposed transitway would begin at an underground station located near the World Trade Center, and proceed north under the new Arterial street. A second rail station in Lower Manhattan would be located between Chambers and Franklin Streets. It would serve residential, institutional and commercial development in the Washington Street Urban Renewal Area and the northern portion of Battery Park City.

Greenwich Village

North of Canal Street along the West Village waterfront, both the Arterial street and the transitway would continue in the same configuration and alignment that occurs in Lower Manhattan. Transit station locations in the Greenwich Village area are proposed to coincide with major local street intersections at Christopher Street and 14th Street. These intersections would connect local streets to both the main northbound and southbound roadways serving adjacent commercial activity and West Village residential areas.

A service road in this area is located on the east side of the Arterial between Christopher Street and 14th Street, and is intended to provide access to existing buildings fronting onto West Street. In order to create a "buffer strip" in front of residential uses such as Westbeth and the West Village Housing Project, the service road has been aligned in such a manner so as to provide a 50-foot strip of land between the curb and building lines. This buffer strip could also be used to serve as a truck parking apron in front of remaining commercial buildings, and to accommodate trucks or trailers which would otherwise block the street. In the Gansevoort-14th Street Meat Market area, a more substantial apron would be provided by shifting the alignment of the Arterial to the west.

Chelsea and Clinton

North of West 14th Street along the Chelsea waterfront to 23rd Street, the alignment of the Arterial has been moved to the east, in order to provide a truck apron area in front of the Chelsea Piers. Due to the restricted amount of space between the pier headhouses and the buildings lining West Street at this location, no service road could be provided, and a parking lane has been added to the otherwise standard six-lane cross-section.

A rail transit station is proposed for the 23rd Street area. From this point, the transitway would follow Eleventh Avenue below grade, and then utilize Penn Central railroad right-of-way through the 30th Street and the 60th Street rail yards to the Riverside Park tunnel portal at 72nd Street.

North of 23rd Street, passing the 30th Street Penn Central yards, a one-way service road would be provided along the east side of the northbound Arterial lanes. The Arterial lanes and service road have been shifted east as far as possible in this area, in order to avoid impacting the 30th Street Heliport and the Colonial Sand and Stone facilities, and to maintain apron space in front of Pier 76. As the Arterial continues through Midtown to 72nd Street, it is anticipated that heavy local traffic from the proposed Convention Center and the new Consolidated Passenger Liner Terminal would be mixing with Midtown traffic heading north to the George Washington Bridge, or south to Lower Manhattan. For this reason, parallel service roads have been added, where possible, to separate through traffic from local movements, and the number of intersections with local streets has been reduced to facilitate traffic flow. Since the Henry Hudson Parkway is elevated over the Penn Central rail tracks at 72nd Street, the Arterial street would climb from grade at 50th Street to approximately plus 60 feet at 72nd Street. Major intersections connecting local streets to both the northbound and southbound roadways would be located at 23rd, 34th, 42nd, 59th and 72nd Streets.

Inboard Alternative

The Inboard alternative consists of three major transportation facilities—a six lane interstate highway, a new transitway, and a rebuilt West Street. These facilities would be located largely in the existing West Street-Twelfth Avenue and Marginal Street right-of-way, near the bulkhead line, from the Brooklyn-Battery Tunnel to 43rd Street

The Inboard alternative presents a range of transportation components which were, to a large extent, planned and designed to preserve the existing character and facilities of the Hudson River waterfront. The existing West Side Highway would be demolished in this alternative. However, few other major waterfront facilities would be disturbed. Pier 40 and the Chelsea Piers would remain essentially as they exist today; the Morton Street Pier would be replaced in part, and while the incinerator at the Gansevoort Destructor would be removed, the Marine Transfer Station for solid wastes would remain. The waterfront facilities along the West Side would continue to serve the same social and economic functions as they do today

At the same time, the preservation of these facilities would place limitations on the potential for new or different uses on the waterfront. Public access to the river edge and waterfront open space would not be significantly altered by the Inboard alternative, except in the West Village area, where the new highway and transitway would be depressed and covered The new highway would not directly initiate any new development or create any new land, except in the West Village and at the Holland Tunnel interchange Neither would the proposed transitway, which is illustrated here with ramp connections for an express bus system, create major incentives for new development In summary, this alternative has been designed to preserve as many of the existing waterfront activities and potentially useful structures as possible.

Program Package Components

The primary components of the program package for the Inboard alternative area briefly described below, and then explained in detail as they apply to each of the four West Side communities.

- The interstate highway would be a six-lane facility and would consist of various depressed, at-grade, and elevated sections from the Brooklyn-Battery Tunnel to 43rd Street. These sections would be either partially covered and ventilated, totally covered and ventilated, or completely exposed, depending upon the nature of present and forecast adjacent land uses, and engineering requirements

- The transitway would be located between the highway lanes in part of the alignment, and would be depressed and covered under the service road in others The transitway could accommodate either bus or rail system, and could be converted from one system to another. The major physical differences between bus and rail systems would be in the provision of tracks or pavement, ramps, station locations and ventilation systems. An Inboard express bus system would run from a station at the World Trade Center and Battery Park City to 23rd Street, and then follow an Eleventh Avenue alignment north to the Penn Central railroad right-of-way through Midtown, the 60th Street yards, and the tunnel under Riverside Park, joining the Henry Hudson Parkway ramps to the George Washington Bridge.

- A service road would parallel both sides of the highway-transitway facility, providing three lanes of traffic in each direction. It would be a continuous at-grade street designed to accommodate local traffic, and to provide parking and storage areas where feasible

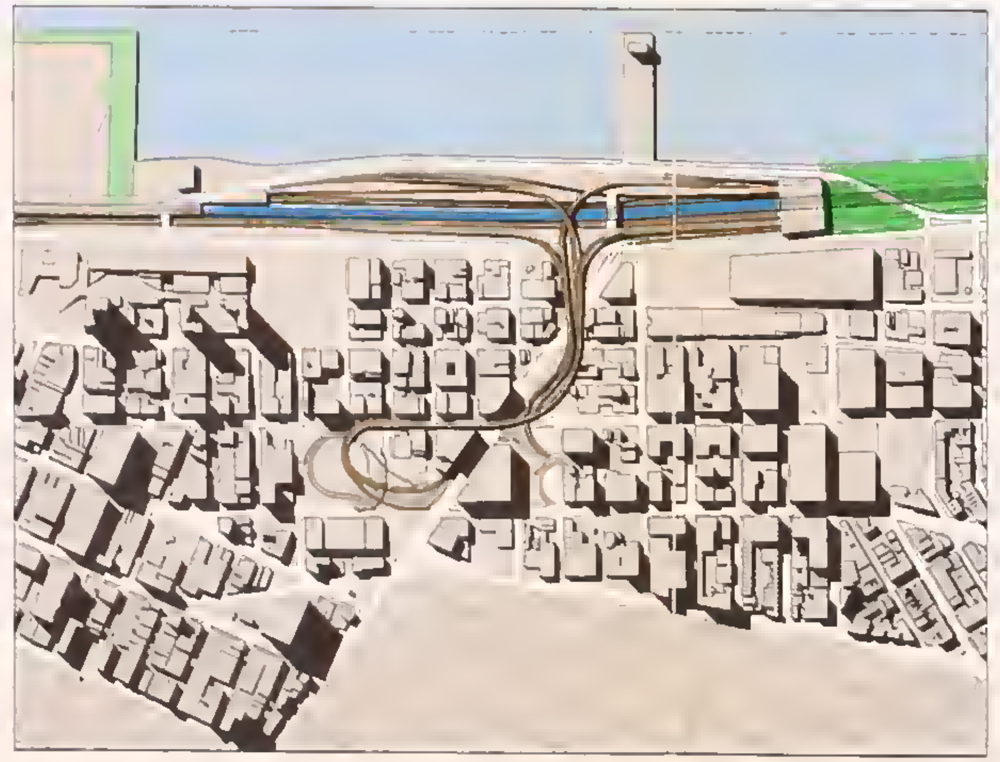
- Full directional interchanges between the new highway facility and the Brooklyn-Battery, Holland and Lincoln Tunnels are proposed. Connections would also be provided to the Battery Park Underpass and 14th Street The new highway would connect back to the existing West Side Highway near 43rd Street

- Approximately 20 9 acres of new land would be created by the Inboard alternative, in the area of the Greenwich Village waterfront It is proposed that this land, which would be located over the depressed and covered highway and transit facility, would be developed for open space and recreation.

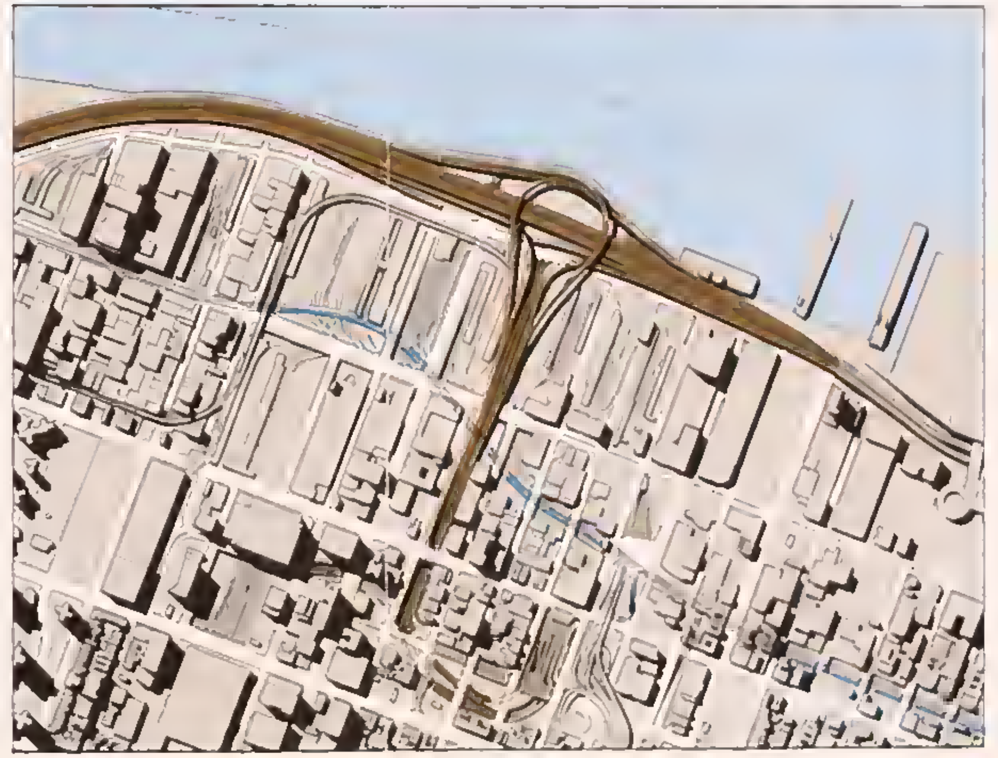
Inboard Alternative

Alternative Holland Tunnel Interchange

Note It would be possible to preserve Pier 40 with this interchange

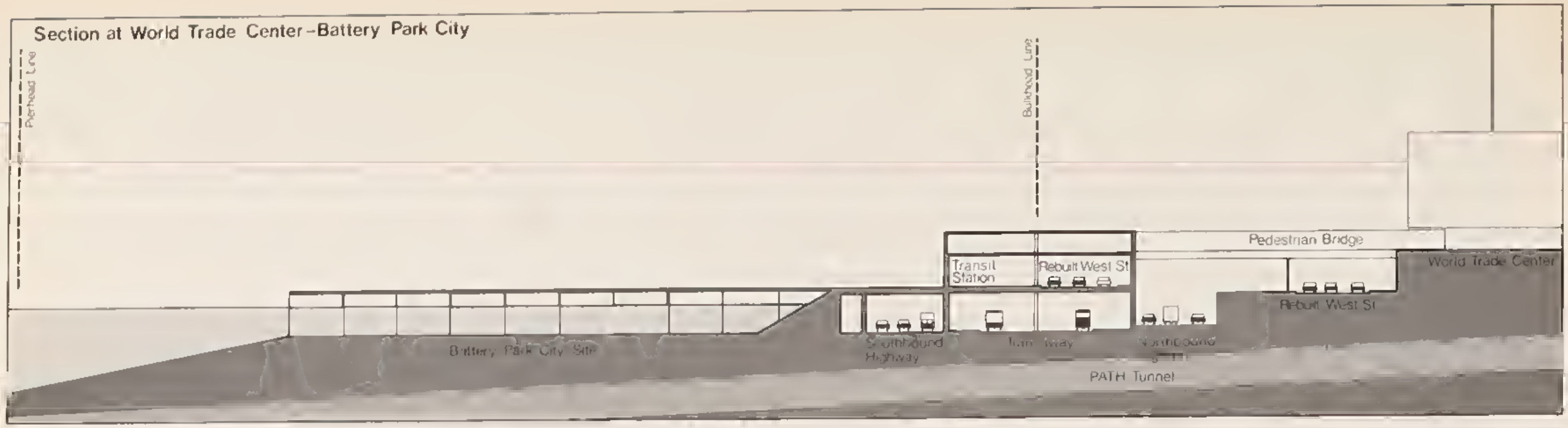


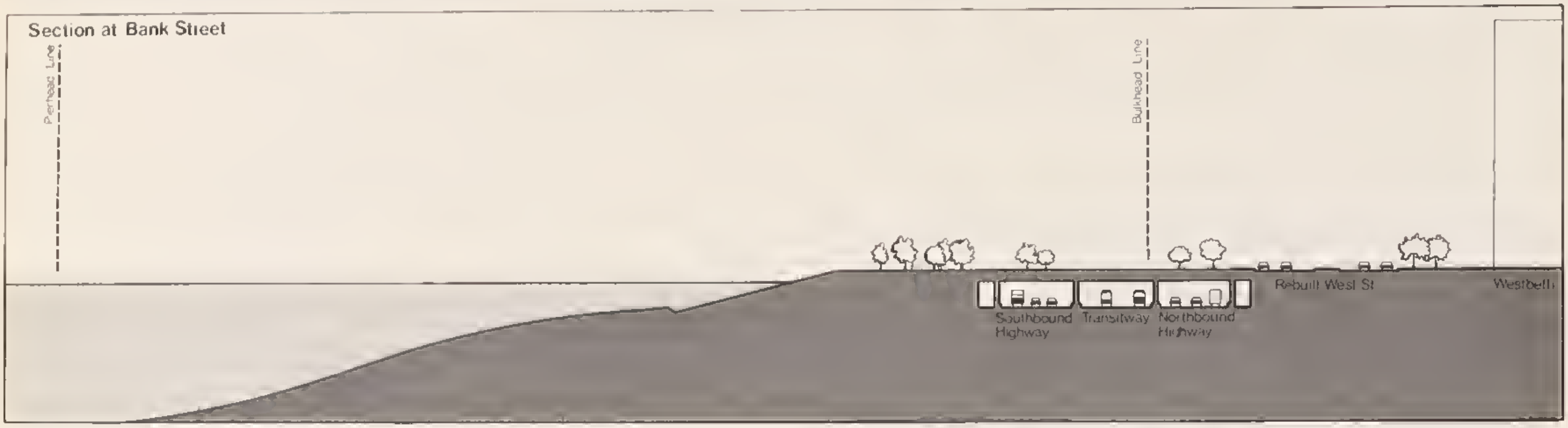
Alternative Lincoln Tunnel Interchange

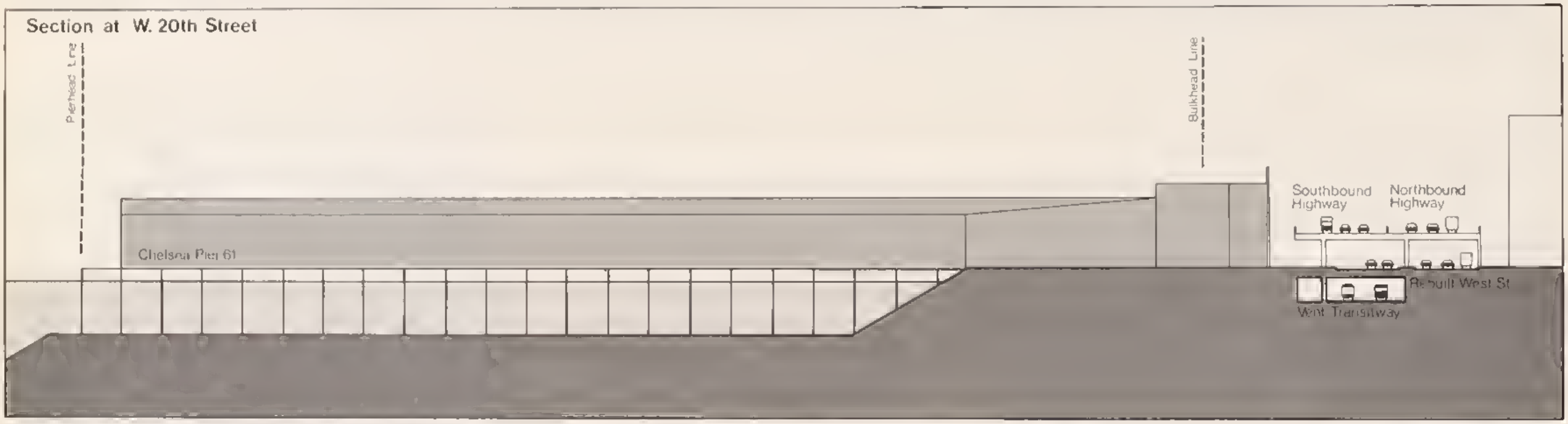


West Side Highway Project Inboard Alternative

▨	Existing Highway Facilities
▨	Proposed Highway Facilities
▨	Proposed Transitway (Covered)
🟦	Proposed Transitway (Uncovered)
🟩	Existing Public Park Lands
🟩	Proposed Public Park Lands
▨	Project Study Corridor
◔	North


Section at World Trade Center–Battery Park City

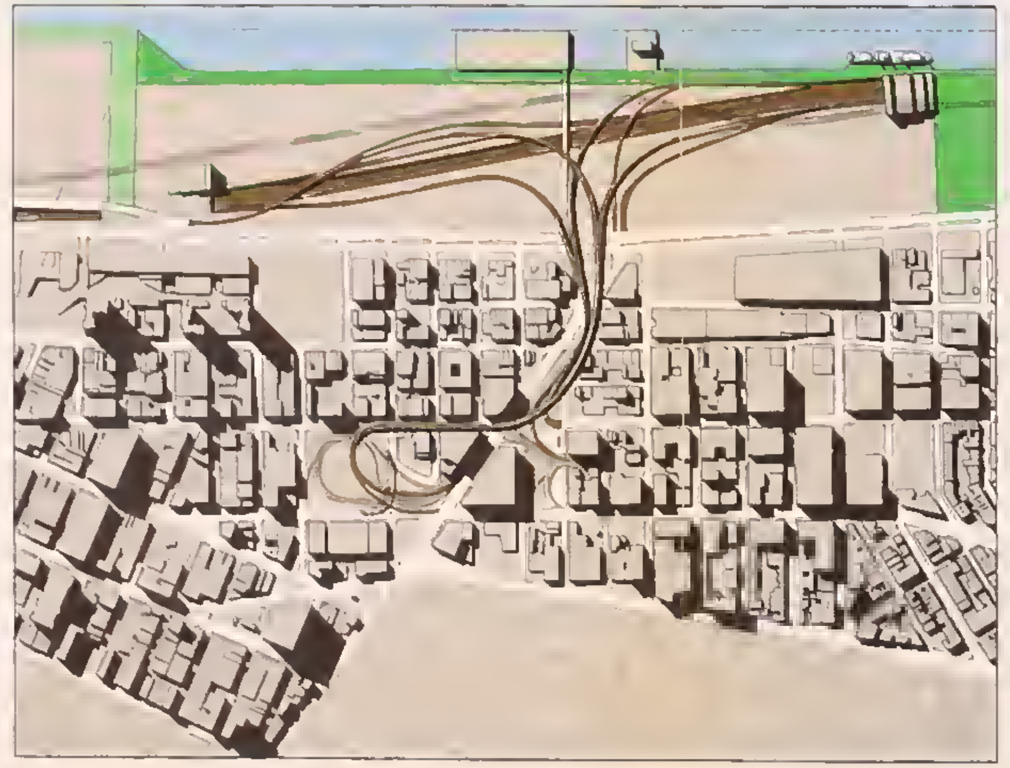

Section at Bank Street


Section at W. 20th Street

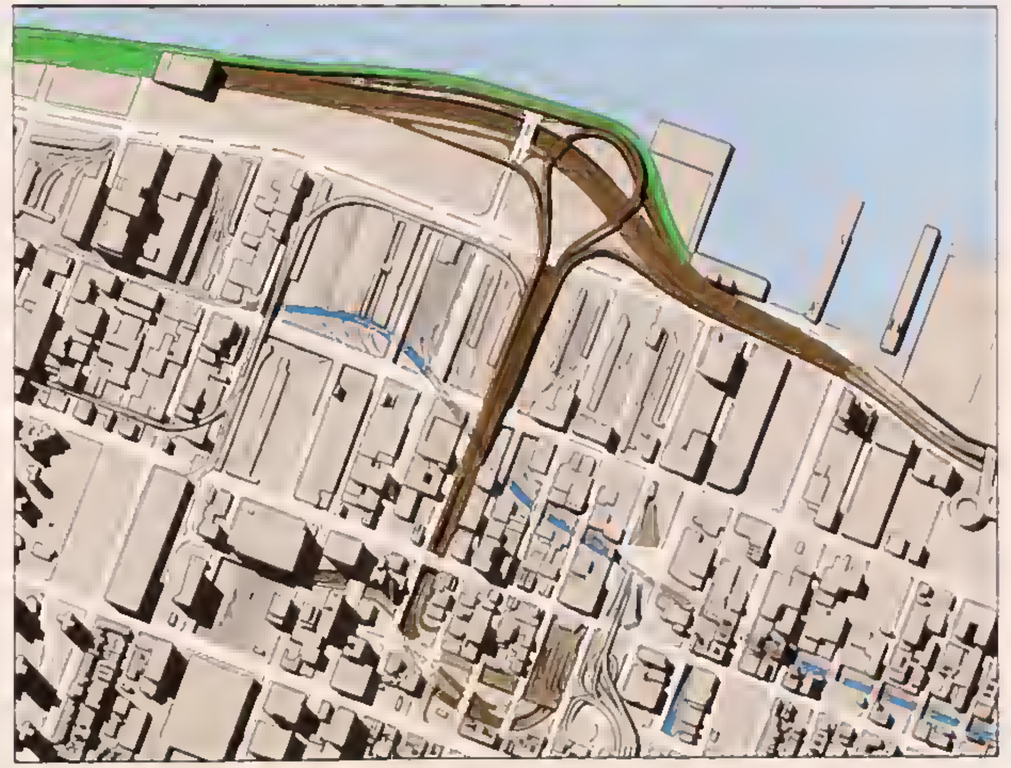
Inboard Alternative Representative Sections

Outboard Alternative

Alternative Holland Tunnel Interchange



Alternative Lincoln Tunnel Interchange

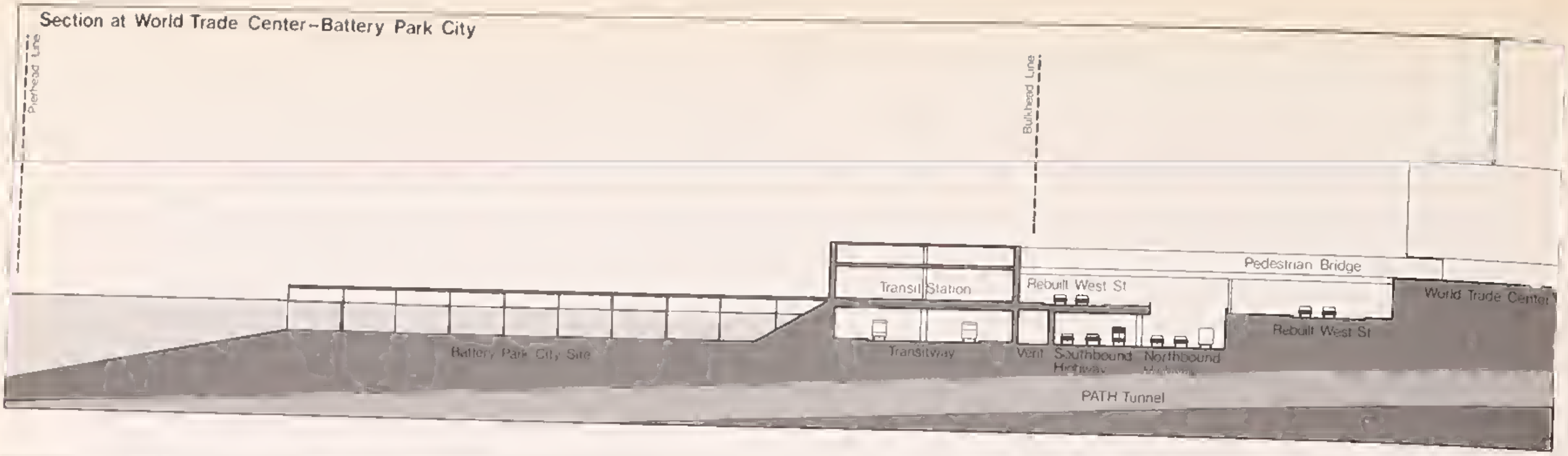


West Side Highway Project Outboard Alternative

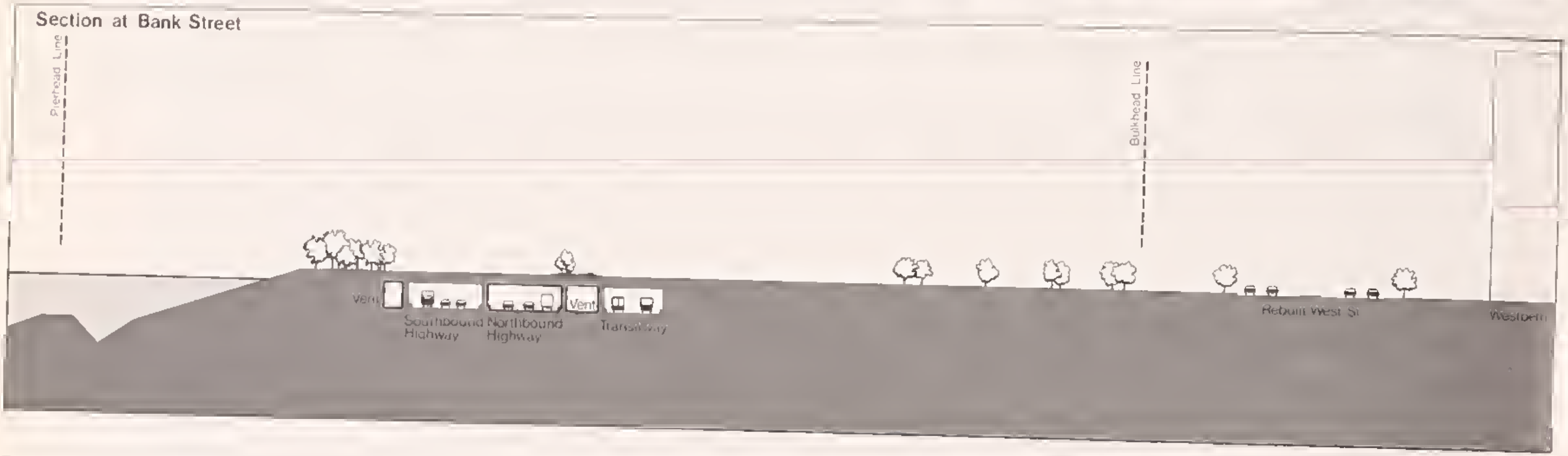
🟫	Existing Highway Facilities
🟫	Proposed Highway Facilities
▨	Proposed Transitway (Covered)
🟦	Proposed Transitway (Uncovered)
🟩	Existing Public Park Lands
🟩	Proposed Public Park Lands
▨	Project Study Corridor

North

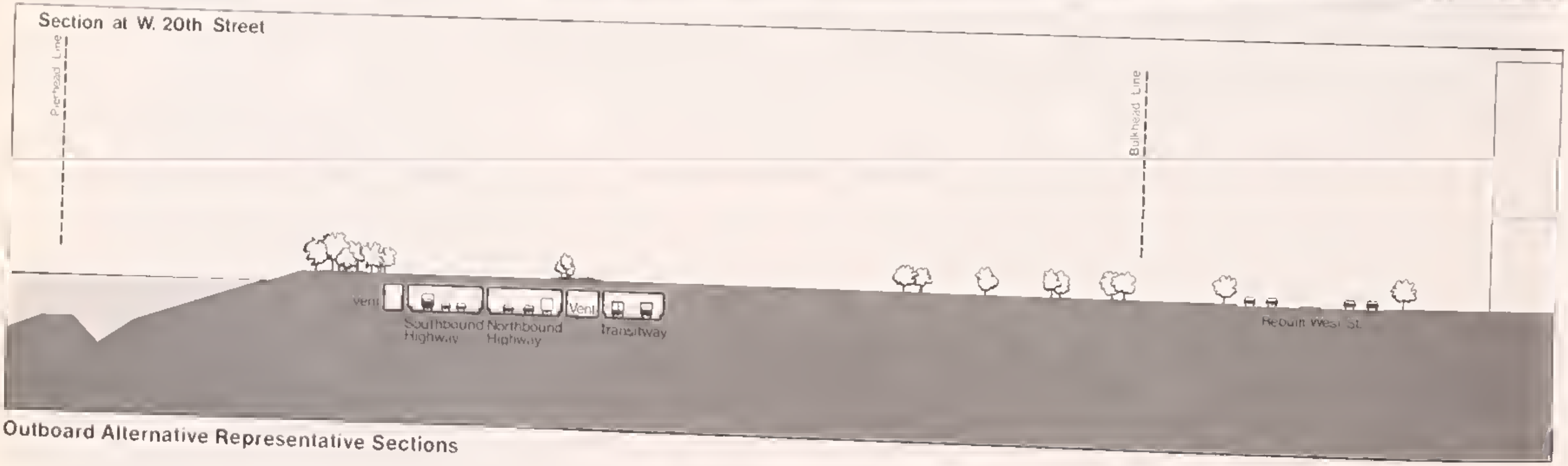
Section at World Trade Center–Battery Park City



Section at Bank Street



Section at W. 20th Street



Outboard Alternative Representative Sections

Lower Manhattan

In Lower Manhattan, both the highway and the transitway would be underground and would follow the existing West Street-Marginal Street right-of-way between Brooklyn-Battery Tunnel and North Moore Street. The highway would also have underground connections to the Battery Park Underpass. The transitway would start from an underground station located west of the southbound roadway, adjacent to Battery Park City and the World Trade Center. Both highway and transit facilities would be covered, except for the northbound lanes of the highway, which would remain open in order to facilitate ramp access and ventilation.

In order to provide for local traffic and pedestrian circulation, a network of surface streets, bridges, and elevated pedestrian walkways are planned. These facilities would include a reconstructed West Street, providing three lanes of traffic in each direction. Between the highway and the local street network, access ramps are proposed at Battery Place, the intersection of Trinity and Greenwich Streets, and at Rector and Barclay Streets. At North Moore Street, the highway would enter an open and depressed section and would start to rise and swing out toward the pierhead line in the new landfill. The transitway would drop down and pass under the highway lanes at approximately Vestry Street and continue north parallel to the highway, but now on its eastern side.

The Holland Tunnel interchange would be a major facility in this area. Two alternative designs are under consideration for this interchange. One alternative would utilize two separate corridors to accommodate elevated ramps to and from the tunnel portals. The other would place all ramps in one corridor above Canal and Hudson Streets. Approximately 47 acres of new land would be created in the interchange area to accommodate transportation facilities, as well as a proposed ventilation building at North Moore Street and a proposed City Sanitation Department facility at Canal Street. The Sanitation Department facility would comprise a relocated Marine Transfer facility and space for other uses, including the parking of buses if an express bus transit alternative is selected. An additional 13 acres would be available for open space along the River between Battery Park City and Canal Street.

Greenwich Village

Along the Greenwich Village waterfront between Canal Street and 14th Street, the highway and transitway would become depressed and covered in new landfill near the pierhead line. Access ramps between the highway and West Street would be provided at Canal Street. Within this area, the section of the facility from Houston to 14th Streets would be totally covered, and ventilation buildings for it would be located at each end. This alignment and configuration would provide 37 acres of continuous public open space along the Village waterfront, permit unhindered pedestrian access to the edge of the water, and would make possible a wide range of activities and development opportunities on 54 acres of newly-created land between the highway and the existing bulkhead line.

Within the right-of-way of West Street-Marginal Street, the existing highway would be demolished and West Street would be reconstructed to provide a service road with three lanes of traffic in each direction, separated by a median. This street would connect with existing cross-town streets, and a 50-foot buffer strip would be provided between it and the existing building line.

In order to help alleviate the heavy truck congestion around the Gansevoort-14th Street Meat Market, the existing alignment of West Street-Twelfth Avenue would be moved to the west, eliminating the tight curve and providing additional truck parking and loading areas. Within the Meat Market, the existing 14th Street would be widened to provide space for market truck loading and parking space. New street lanes would be created by acquiring and demolishing the buildings along the north side of 14th Street between West Street and Ninth Avenue. The affected businesses could be relocated within the existing market area. The new 14th Street traffic lanes would be extended west at grade into the landfill area to a location near the highway-transit facilities, close to the pierhead line.

Direct access ramps would be provided between the highway and the new 14th Street and West Street. Ramps from the transitway for an express bus system would be integrated with the highway structure in order to provide access to 14th Street and cross-town distribution routes. Related facilities at 14th Street would include ventilation buildings servicing covered sections to both the north and south of the area, and possible relocation sites for police and fireboat facilities which would be displaced from their existing location at the Gansevoort Pier.

Chelsea and Clinton

From 14th to 27th Streets, in the area of the Chelsea waterfront, the highway would continue in a depressed, covered and ventilated section near the pierhead line. Similar opportunities for open space along the River and offshore development would be possible along the Chelsea waterfront. In this area, 22 acres would be provided for a continuous park along the River, and 25 acres would be available for other types of development. The reconstruction of West Street-Twelfth Avenue would also proceed in the same manner adjacent to the Chelsea Triangle as in the West Village.

At 23rd Street, the transitway would either swing east and continue north under Eleventh Avenue, or remain in the highway alignment to 42nd Street and then continue under Twelfth Avenue. In the case of an express bus system using the Eleventh Avenue option, access to and from the transitway would be provided at 23rd Street and near 41st Street in the vicinity of the Lincoln Tunnel plaza and the Port Authority Bus Terminal. These ramps would serve proposed crosstown distribution routes.

At 27th Street, the Outboard highway would leave the depressed and covered section and rise to an elevated configuration to provide for connections to the Lincoln Tunnel. Two single corridor configurations are under consideration for this connection—one at 30th Street and the other at 35th Street. Both would provide direct connections to the tunnel portals by way of elevated ramps, as well as direct connections to the local street network by way of West Street-Twelfth Avenue. In the interchange area, 38 acres of new land would be created and provision made for continuous public access to the edge of the River, and the location of a replacement Marine Transfer Station for the City Sanitation Department. North of the interchange ramps, the highway would connect into the existing West Side Highway at approximately 42nd Street.

Probable Impacts of the Alternatives

Section 4 Probable Impacts of the Alternatives

Social and Economic Impacts

The Borough of Manhattan, and more particularly the Central Business District from 59th Street south, is the heart of the New York Region, the place that gives this metropolitan area its unique character. Manhattan's contributions to the overall economy and finances of New York City are inestimable and irreplaceable. Manhattan provides 48 percent of the total City real estate taxes and 71 percent of the payroll taxes. The continued viability and growth of the borough and its employment base are critical concerns of the City's efforts to deal with the social, environmental and economic problems that it faces.

The Steering Committee was particularly sensitive to the vital economic role of Manhattan when it developed the policy statements which have guided the West Side Highway Project. In particular, it told the Project to:

- **Recognize that existing waterfront usage as well as revitalization of the West Side waterfront area is an essential consideration in planning and design of the reconstructed facility.**

- **Determine the best means to maintain and/or enhance the existing social, economic and physical characteristics of the local areas through which the facility passes or abuts, in concert with the local area goals and objectives; both during and after construction.**

- **Investigate the role of goods distribution and production activities along the corridor and, where feasible, develop a means to preserve land areas and develop facilities for the purpose of reducing the cost and increasing the efficiency of providing goods and services for Manhattan— with particular attention to the areas in close proximity to the Lincoln and Holland Tunnels.**

- **Develop plans that will assist in the consolidation of motor, rail, and sea borne goods movement, storage, and distribution activities along the project corridor.**

- **Develop alternative land use strategies that promote orderly rather than precipitous change along the waterfront consistent with the adjacent neighborhoods.**

- **Formulate in conjunction with the City and adjacent communities realistic access and waterfront use guidelines to frame future usage of the waterfront area to be accomplished in concert with the highway facility.**

Detailed descriptions of the existing social, physical and economic conditions of the Region, the City and West Side between Midtown and the Battery were discussed in Section 2 of this Statement. Utilizing this information as a basis for evaluation, probable effects of the five alternatives are assessed here. This evaluation projects into the future the previously presented profiles of the Study Corridor and each local community. The discussion here deals with conditions that are in the process of change, as well as those which are forecast to remain relatively stable.

Much is at stake in terms of jobs, housing, and the particular objectives of each local community and the entire city. Each alternative, depending on the various transportation components, construction proposals and implementation schedules, would provide different incentives for change that could alter and in some cases redirect current trends.

Trends in the Study Corridor

Most traditional economic functions on the West Side, such as maritime commerce, rail freight and manufacturing are declining, and will continue to do so with or without implementation of any particular project alternative. At the same time, office, institutional and commercial sectors are expanding, despite temporary fluctuations due to national economic trends. Shifts in the economic base of the Corridor are precipitating changes in population, employment, housing and the need for new facilities and services. The present Corridor population of 121,000 is expected to reach approximately 170,000 by 1995. These new residents will increasingly occupy buildings and land that were once used for manufacturing. The Corridor currently provides employment for almost 444,000 people of all incomes. This number is projected to increase to between 511,000 and 594,000 by 1995, and will be largely due to new commercial projects located in Lower Manhattan, rather than to the expansion of existing economic functions within the Study Corridor.

The thrust of City policy is to accommodate these trends by consolidating industrial and municipal service activities around viable manufacturing areas, such as the Holland and Lincoln Tunnel portals, while advancing residential strategies aimed at preserving the existing housing stock, conversion of underutilized lofts, and where feasible, new construction. These policy objectives are summarized in the City Planning Commission's **Draft Upland Study**:

- **Maintain existing housing stock and residential neighborhoods.**

- **Promote development of white collar employment.**

- **Stabilize and develop quality job intensive blue collar industries.**

These Corridor-wide trends and City policies are qualified by the distinct characteristics and objectives of local communities, each with a different relationship to the existing Highway and proposed alternatives. **Lower Manhattan** is a unique community where much future development, both upland and off-shore, is firmly planned or under construction. Potential impacts would most likely be limited to conformance with existing plans or proposals, work force access to Lower Manhattan, and the consequences for stability and growth of the business community. In the remaining three residential communities of the Study Corridor, uncertainty is more prevalent, new construction is sporadic, and future plans are tentative. Probable impacts on these areas would have broader implications geared toward local issues, and would be subject to a higher degree of uncertainty.

Greenwich Village is an old, established community of increasing affluence, and strong residential attraction. It has a history of population changes, resulting in residential expansion into adjacent industrial areas. This trend is occurring along the waterfront area, accompanied by issues concerning the type and scale of future development, as well as the expansion of recreational amenities. Traditionally, **Chelsea** has been a lower income community and the source of blue collar employment for surrounding maritime and manufacturing areas. A gradual influx of middle income residents has prompted residential conversion, rising property values and housing demand. The viability of the Chelsea waterfront as an employment center is a critical issue in the face of such redevelopment pressure. The **Clinton** community faces pressures from commercial and residential expansion of Midtown, and the redevelopment of the waterfront. Proposals are now being advanced by the City to preserve and stabilize the Clinton area

Population

The Study Corridor is expected to gain at least 48,500 people by 1995, or roughly a 40 percent increase over the 1972 population. Based on current trends, this increase is likely to result in a redistribution of the total population, as well as traditional racial and income patterns. Although the Corridor has experienced an overall decline in total population, losing 10.8 percent during the 1960-1970 period, this decline is now leveling off. Slight population increases were recorded in Greenwich Village between 1970 and 1972, and dramatic increases are planned for Lower Manhattan, with the completion of major residential projects in this area.(See Table 30.)

Table 30 **Population Characteristics in the Study Corridor 1960-1970**

	Lower Manhattan		Greenwich Village		Chelsea		Clinton		Total	
	1960	1970	1960	1970	1960	1970	1960	1970	1960	1970
Total Population	723	540	37,743	37,485	45,877	41,597	51,537	41,576	135,880	121,198
Racial Composition										
White	692	485	36,478	35,054	43,538	37,457	49,382	37,823	130,090	110,819
Black	23	26	1,024	1,768	2,027	3,037	1,549	2,181	4,623	7,012
Other	8	29	241	663	312	1,103	606	1,572	1,167	3,367
Puerto Rican(a)	(56)	(25)	(984)	(724)	(10,246)	(5,749)	(6,426)	(5,039)	(17,712)	(11,537)

(a) Numbers in parentheses not included in total.

Source: United States Census.

The racial composition of the Study Corridor in 1995 is expected to be predominantly white, with less than 20 percent of the total in a minority group category, based on current trends. In a uniform manner throughout the Corridor, the number of Blacks has increased slightly during the past decade, while Puerto Ricans have experienced a slight decline. The most dramatic shift in minority group population occurred in Chelsea, where the Puerto Rican population has declined 50 percent since 1960.

While total population declined during the sixties, median family income in the Corridor almost doubled. This change was due primarily to the sharp decline in the low and moderate income categories, under $10,000 yearly, accompanied by an increase in the middle income category, or those earning over $10,000. This shift closely parallels the overall redistribution of racial patterns, and indicates a trend toward increasing affluence of new Corridor residents, due to the gradual displacement of lower income, minority group residents. (See Table 31.)

Employment

Of the 68,000 new jobs projected for the Corridor by 1995, roughly 80 percent will be the result of office and institutional growth in Lower Manhattan. Recent trends point to continued contraction of traditional blue-collar manufacturing functions, with a gradual expansion of white-collar businesses. Despite renewed optimism concerning the future growth of the office sector in Manhattan, it is expected to increase at a rate somewhat lower than the national average, and will continue to be closely tied to fluctuations in the national economy.

In terms of Corridor residents, these shifts in the Manhattan economic base will continue to be reflected in the occupations of Corridor residents. Traditional centers of blue-collar employment, such as Chelsea and Clinton, have experienced sharp decline in these occupational categories since 1960, with parallel increases in the number of white-collar residents in Chelsea and Greenwich Village. As a result, redistribution of white-collar and blue-collar occupations is expected to continue, following the similar patterns of racial and income redistribution. (See Table 32.)

Housing

Changes in population and employment during the past 15 years have initiated clearly identifiable trends within the Corridor housing stock which are expected to continue with increasing momentum until 1995. As higher income white collar workers continue to seek housing in the Corridor, pressure on existing residential areas will increase. These pressures will lead to expansion of existing residential areas into adjacent manufacturing districts, such as the case with Greenwich Village. In other communities like Chelsea, conversion of the existing housing stock and the displacement of lower income minority residents will continue to be the basic trend. Overall, demand for additional housing will remain strong throughout the Corridor (See Table 33.)

Table 31 **Family Income Characteristics in the Study Corridor 1960-1970**

	Lower Manhattan		Greenwich Village		Chelsea		Clinton		Total	
Income Level	1960	1970	1960	1970	1960	1970	1960	1970	1960	1970
$ 0– 3,999	35	9	1,669	871	3,999	1,204	4,138	1,833	9,841	3,917
$ 4,000– 9,999	71	33	4,706	2,402	4,987	3,367	6,312	4,006	16,076	9,808
$10,000–14,999	14	24	1,310	1,520	1,014	2,050	1,074	1,761	3,412	5,355
$15,000–24,999(a)	8	14	983	1,689	508	1,511	625	1,121	2,124	4,335
$25,000 and over	–	6	–	1,077	–	580	–	502	–	2,165
Total Families	128	86	8,668	7,559	10,508	8,712	12,149	9,223	31,453	25,580
Median Family Income	$5,625	$10,158	$6,765	$11,424	$5,086	$9,615	$5,231	$7,948	$5,592	$9,315

(a) In 1960, $15,000 was upper income level.

Source: United States Census.

Table 32 **Occupations of Study Corridor Residents 1960-1970**

	Lower Manhattan		Greenwich Village		Chelsea		Clinton		Total	
	1960	1970	1960	1970	1960	1970	1960	1970	1960	1970
White Collar										
Professional, Technical and Managerial	47	114	8,941	11,463	5,691	7,507	5,070	5,859	19,749	24,943
Clerical and Sales	95	49	6,221	6,714	5,792	6,979	5,977	6,093	18,085	19,835
Service	120	38	1,556	1,525	3,228	2,400	5,137	3,710	10,041	7,673
Subtotal	**262**	**201**	**16,718**	**19,702**	**14,711**	**16,886**	**16,184**	**15,662**	**47,875**	**52,451**
Blue Collar										
Craftsmen Foremen and Operators	78	39	3,223	2,065	6,041	4,036	6,163	4,082	15,505	10,222
Laborers and Private Household Workers	29	23	713	482	1,211	592	1,438	927	3,396	2,024
Subtotal	**107**	**62**	**3,941**	**2,547**	**7,252**	**4,628**	**7,601**	**5,009**	**18,901**	**12,246**
Total	**369**	**263**	**20,659**	**22,249**	**21,963**	**21,514**	**23,785**	**20,671**	**66,776**	**64,697**

Source: United States Census.

Table 33 **Housing Characteristics in the Study Corridor 1960-1970**

	Lower Manhattan		Greenwich Village		Chelsea		Clinton		Total	
Unit Status	1960	1970	1960	1970	1960	1970	1960	1970	1960	1970
Owner	5	4	771	735	251	2,699	384	177	1,411	3,615
Renter	377	303	17,534	20,578	22,691	19,239	23,776	21,950	64,378	62,070
Occupied	382	307	18,305	21,313	22,942	21,938	24,160	22,127	65,789	65,685
Unoccupied	58	36	865	886	2,182	893	1,374	1,280	4,479	3,095
Total Units	**440**	**343**	**19,170**	**22,199**	**25,124**	**22,831**	**25,534**	**23,407**	**70,268**	**68,780**
Median, Rooms Per Unit	NA	NA	NA	2.79	NA	2.70	NA	2.71	NA	2.75
Median, Persons Per Unit	NA	NA	NA	1.37	NA	1.29	NA	1.31	NA	1.33
Median, Gross Rent per Month	$52	$83	$74	$128	$67	$113	$77	$102	$68	$115

NA Not Available

Source: United States Census.

Community Facilities and Services

The ability of the City to supply the required public facilities and services to projected Corridor growth is an important consideration in assessing transportation alternatives. Each alternative would influence but not force any level of projected growth. Each would influence its distribution and, thus, affect the supply and distribution of public facilities and services. This situation would be most prominent with the Outboard alternative, where approximately 120 acres of new land could be made available for development along with approximately 80 acres of parks, playgrounds and open space.

Health

There are presently six general care hospitals in the Corridor, with some 2,400 beds serving local residents and other communities. Using a national average of four beds per 1,000 persons, these facilities could serve the major medical needs of 600,000 people, well beyond the existing Corridor or projected population. There are numerous other medical services. Several of these are planning expansion programs while others have sufficient capacity to serve additional residential development.

Education

The entire Study Corridor is included in School District 2, which covers most of Manhattan south of 59th Street, and the Upper East Side to 96th Street. The adequacy of existing educational facilities and the projection of future needs is determined generally on a district rather than a community basis. For this reason, the location of area high schools often bears little relation to the residence of many of the students, and the use of public transportation is considered a normal means of getting to and from school. Since high school students would constitute only a modest component of total population growth, it is likely that existing and planned high school capacity in the district could be pooled and used to absorb projected growth on the West Side.

The location of elementary and intermediate public schools is more directly related to the local communities which they serve. According to 1970-1972 elementary and intermediate enrollments within Corridor schools, the existing facilities were operating below capacity and could accommodate an additional 2,300 students. By 1995, a projected student increase of from 3,100 to 7,900 West Side pupils will still not completely absorb the estimated excess capacity of 8,600 seats provided by existing and planned facilities. Some alterations will be required in the planned location of new elementary school facilities based on the new distribution of residential development. (See Table 34.)

Table 34 **Existing and Projected Excess Student Capacity in the Study Corridor**

	1972 Existing Excess Capacity	1995 Planned Excess Capacity(a)	Additional Students(b)	Excess Capacity(b)	Additional Students(c)	Excess Capacity(c)
Lower Manhattan	–	5,000	2,718	2,282	3,570	1,430
Greenwich Village	1,064	1,532	135	1,397	890	642
Chelsea-Clinton	1,195	2,060	277	1,783	3,410	−1,350
Total	2,259	8,592	3,130	5,462	7,870	722

(a) Includes existing excess capacity plus planned additions.

(b) With Low Estimate of 1995 Students

(c) With High Estimate of 1995 Students.

Source: Board of Education, City of New York, Proposed 1972-1973 School Building Program, 1973-1978 Capital Improvement Plan, September, 1971, and "Utilization of School Buildings," Borough of Manhattan, October, 1971.

Public Safety

The number of active fire stations on the West Side has declined over the years, due to the shrinking manufacturing base in the area. New development could create a need for new facilities. There are no specific criteria requiring the establishment of a certain number of fire stations to serve a given population. Rather, an index of adequacy is the length of time incurred to respond to a particular area. In other words, population growth does not necessarily require additional fire stations, as long as the response time is within established standards.

In view of the geographic distribution of the existing 13 fire stations, it is likely that additional upland growth generated in the Corridor under any Project alternative could be adequately served. The need for additional facilities in new landfill areas would have to be closely evaluated by public safety officials. A similar assessment would be required of the existing six police precincts.

Water

The City Department of Water Resources, based on discussion with Project staff, estimated that future demands on water supply could be accommodated by existing or currently proposed water supply facilities within the West Side Corridor. Where new residential development and additional population have been forecast, the potential increase in demand of 9.3 million gallons per day would not seriously strain projected supply.

Sewers

Of the two sewage treatment plants currently serving the Corridor—Newtown Creek south of Bank Street and the North River plant north of Bank Street—only one will have excess capacity to handle any additional flows generated by the Outboard alternative. Arrangements have already been made for the Newtown Creek plant to accept additional flows generated by Battery Park City, leaving no excess capacity in either the interceptor or at the plant. However, because of the new North River Treatment Plant on the Hudson at 145th Street, and the new West Side interceptor sewer, some excess capacity exists in these facilities for the transfer and treatment of the additional waste water flow from new development areas north of Bank Street.

Electric Energy

Potential energy requirements were estimated by Consolidated Edison, based on a range of growth projected by the Project for the year 1995. In terms of electricity, it was estimated that during peak periods, additional demand would range from approximately 60 to 120 megawatts

Based on these high and low estimates, a cost comparison was made between supplying these loads to the relatively concentrated area of development, or supplying the same amount of service to a similar amount of new development scattered throughout Manhattan. This comparison assumed that the projected amount of development would occur by 1995 with any alternative. It was estimated that the cost would be $14 million for the high range and $8.5 million for the low range. The cost of providing similar facilities to service loads of the same magnitude, but scattered throughout Manhattan would be approximately $16 million for the high range, and $9 million for the low range. These estimates were calculated in current 1974 dollars.

Land Use and Community Character

The continuation of present Corridor trends in population, employment, housing and the need for public facilities and services is expected to prevail under all Project alternatives. Likewise, the amount of projected population and employment growth in the Corridor by 1995 would not be significantly different among any of the alternatives. On the other hand, the five alternatives would vary considerably in the number and degree of incentives for change attributable to a new transportation facility. Such incentives could alter current trends within any given local community. The most prominent incentive would be the creation of a large amount of new land with the Outboard alternative. While not affecting the total amount of Corridor growth by 1995, this proposal would directly affect the distribution of projected population increases.

The influence of any alternative upon the growth and development of constituent communities within the Study Corridor would ultimately determine the extent to which West Side social patterns, commercial activities and employment would be affected by this Project. These considerations are discussed below, based on detailed material presented in Section 2. The reader is referred to this material, as well as the appropriate Project technical reports on Corridor communities and industries.

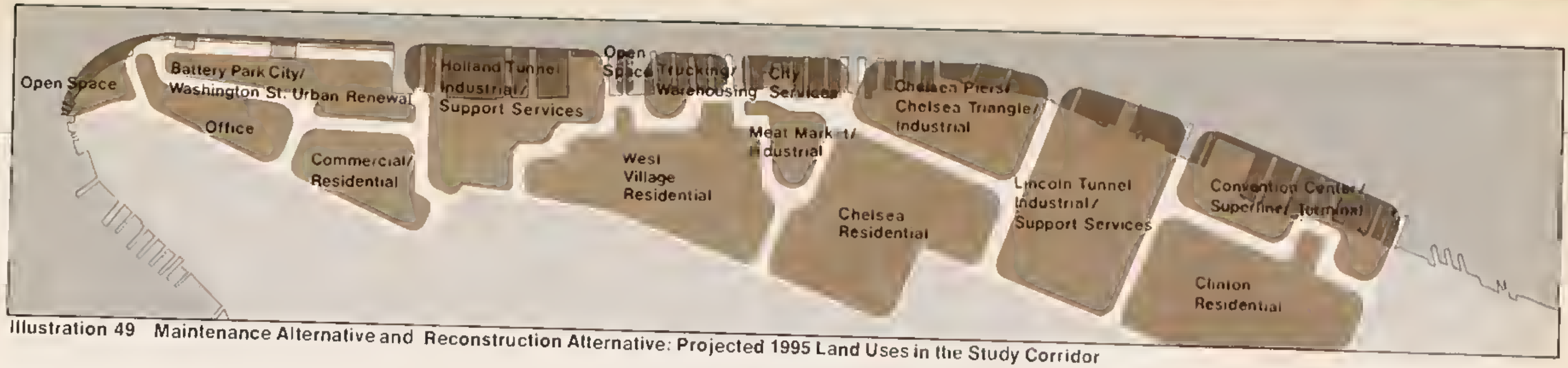


Illustration 49 Maintenance Alternative and Reconstruction Alternative: Projected 1995 Land Uses in the Study Corridor

Maintenance and Reconstruction

These two alternatives are discussed together because their primary effects on the land use and character of adjacent communities would be very similar. The notable differences are that the Reconstruction proposal would accommodate trucks and buses on the highway facility, and would have several direct impacts on adjacent land uses.

Like many other facilities along the Hudson River waterfront which have outlived their original functions, the existing West Side Highway is a relic of the past. It has a deteriorating influence on waterfront property and seriously limits the options for future reuse of this potentially valuable real estate. During the next 25 years, it would continue to act as a physical, environmental, and aesthetic barrier between adjacent communities and the waterfront. The anticipation of frequent closings and detouring for capital maintenance or reconstruction during the 12 year construction period would handicap the use and revitalization of the entire Corridor area.

Lower Manhattan This community is taking positive steps to reshape community character and cohesion so that a residential, 24-hour population is established within the context of an expanding business environment. This policy is the result of close cooperation between the City and local businessmen, and is manifested by planning and construction of three new "walk to work" communities located on the periphery of the area, the construction of new office complexes such as the World Trade Center, and the provision of new public transit facilities.

The Maintenance and Reconstruction alternatives, to some extent, would contradict community objectives stated in the Lower Manhattan Plan, which specifies that peripheral highways should be reconstructed below grade, with service traffic at grade and major pedestrian movements above grade. Since the existing elevated structure occupies the same space as proposed pedestrian bridges between Battery Park City and the mainland, these alternatives would preclude the completion of the pededestrian network at the 30-foot level, as specified in the Greenwich Special Zoning District, the Battery Park City lease and master plan, and the Washington Street Urban Renewal plan.

As well as impairing pedestrian movement, these alternatives would be a barrier to visual cohesion between Battery Park City and upland development, due to the appearance and elevated configuration of the existing Highway. These alternatives would provide little change in accessibility to Lower Manhattan by either public transit or vehicular traffic, although goods movement by truck would be improved by Reconstruction.

The Holland Tunnel area is currently used as a low-cost warehousing, distribution, and light manufacturing district, and is expected to remain so with the Maintenance alternative. Importantly, this area contains the largest concentration of printing and graphic arts firms in Manhattan, a source of high quality blue-collar jobs. Development pressures on this area from adjacent residential projects and the expanding business community are expected to increase over the long run.

If trucks were permitted to use the West Side Highway, as proposed with the Reconstruction alternative, the strategic location of the area between the Holland Tunnel portals and the Canal Street entrance ramps would be enhanced. This improved accessibility for the trucks would tend to preserve existing uses and reinforce City policy to eventually create a municipal services district. However, whether this potential land resource can be retained as a support center for CBD activities will ultimately depend on its future market potential for competing uses, and the commitment of the public sector to pursue its objectives for the area.

Greenwich Village The goal of the West Village to extend its residential character to the waterfront would be limited by the Maintenance and Reconstruction alternatives, and the acceptability of housing next to an elevated highway. Market conditions will be tested in the immediate future by the West Village Housing Project, a 420 unit low-rise residential development located adjacent to the West Side Highway. Recently reported figures produce an average cost of $60,000 per dwelling unit. This project, designed in the character and style of existing village neighborhoods, is expected to establish the viability for additional new construction. While the Reconstruction alternative would tend to temporarily reinforce existing trucking activities in the southern sector of the Village waterfront rather than accommodate residential trends, these activities would continue with less intensity and undergo gradual attrition due to rising land values.

With limited areas for residential expansion, West Village property values could be expected to rise, assuming the continuance of the present demand. Values of industrial sites along West Street may remain relatively low, while values of residential property further upland would increase the most. Present real estate activity in the area between Hudson and West Streets indicates a gradual increase in the number of recorded sales between 1969 and 1972.

This increased activity has resulted in increases in both the assessed value and sale price of waterfront property. The cost of commercial land assembled for the West Village Housing Project averaged $30.50 per square foot, and resulted in a new residential assessed valuation of $52 per square foot, up from $10.50 per square foot in 1969.

Recorded Sales in the West Village Waterfront Area
Hudson Street to West Street

	1969	1970	1971	1972(a)
Residential	1	9	13	21
Commercial-Industrial	9	14	12	17
Total	10	23	25	38

(a) Includes the first month of 1973.

Continued redevelopment for housing would require additional residential amenities that would not be provided by either the Maintenance or Reconstruction alternatives. While the elevated structure permits frequent points of access to the waterfront, community use of the limited number of existing recreation facilities would continue to be difficult.

The Gansevoort-14th Street Meat Market is expected to remain a viable West Side industry for the foreseeable future under both the Maintenance and Reconstruction alternatives. Since no access ramps are provided at 14th Street with either alternative, these proposals would have little or no direct effect on the area. However, because of the interdependence of market businesses, and competition from new markets, this area is vulnerable to change in the more distant future.

Chelsea and Clinton The Chelsea Triangle, presently used for truck storage, truck rental and warehousing, encompasses an area between the Chelsea Piers (58-62) and Tenth Avenue south of 23rd Street. While the pier facilities may be not adequate or desired for cargo shipping, they are in sound physical condition and should remain so in the future with the Maintenance and Reconstruction alternatives, if protected from fire and vandalism. At a minimum, it is likely they would be used by the City for interim storage and maintenance purposes. The uncertainty of highway repair projects, limited back-up space, and poor maneuvering area will handicap the leasing of these piers for private uses, especially uses that generate a high employment density and trucking activities.

The combined effect of the existence of the piers, the elevated highway and access ramps at 23rd Street should prolong the presence of existing mixed uses in adjacent areas with the Reconstruction alternative. This effect would coincide with present City policy.

How far upland these effects would occur and how they would influence the nearby Chelsea residential neighborhoods cannot be determined precisely. The demand for housing in Chelsea is growing. If the use of the 14th Street railroad viaduct is eventually discontinued, an important barrier between the Triangle area and existing Chelsea neighborhoods would be eliminated, and pressures to redevelop Tenth Avenue for residential uses would be intensifed.

Such an occurrence would tend to offset some industrial deterioration in the Chelsea Triangle by the relocation of displaced firms into available space.

However, the Maintenance or Reconstruction alternatives would not significantly influence such redevelopment pressures and would limit the amount of potential residential expansion toward the waterfront. Therefore, the net effect of these alternatives would be to contain demand for housing in the existing residential neighborhoods, thus increasing property values, or force residential encroachment into the industrial areas to the east of Chelsea.

North of 23rd Street, the sound but underutilized high density industrial buildings between Tenth and Twelfth Avenues would benefit by improved truck access afforded by new ramps with the Reconstruction alternative. Increased pressure for reuse of both the 24th and 28th Street Railroad Yards as truck storage areas is also likely. However, the highway would have no effect on attracting new, job-intensive industries to this area.

Although an elevated highway past the Penn Central 30th Street Yards would reinforce current City policy to maintain this area as a CBD support and goods distribution center, these alternatives would not ensure the long-term utilization of the yards for such purposes. This sizeable tract of land close to the Midtown business district will come under increasing pressures from the private real estate market for large scale development plans, particularly if railroad activity continues to decline as forecast. Existing trends in the Clinton community would not be significantly altered. Redevelopment pressures from the Midtown business district, existing or planned projects on the waterfront and special district zoning mechanisms would continue to shape the future of the community.

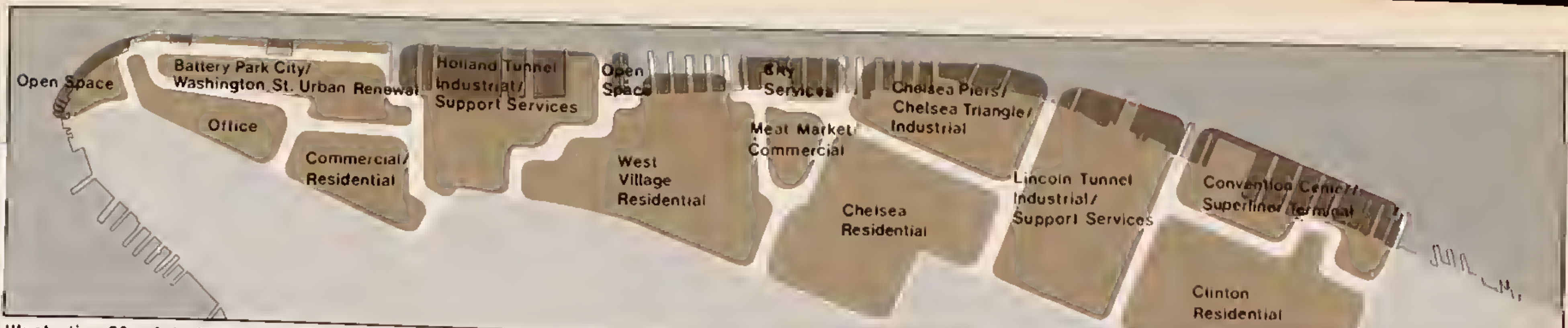

Open Space
Battery Park City/ Washington St. Urban Renewal
Holland Tunnel Industrial/ Support Services
Open Space
City Services
Chelsea Piers/ Chelsea Triangle/ Industrial
Office
Commercial/ Residential
West Village Residential
Meat Market/ Commercial
Chelsea Residential
Lincoln Tunnel Industrial/ Support Services
Convention Center/ Superliner Terminal
Clinton Residential

Illustration 50 **Arterial Alternative: Projected 1995 Land Uses in the Study Corridor**

Arterial
Unlike the Maintenance and Reconstruction alternatives, the Arterial street with a transitway is expected to stimulate a set of redevelopment forces that would be moderated primarily by the demand and supply of the real estate market. Elimination of the existing elevated Highway, the locational benefits of the waterfront, and the convenience of rail transit access to the business districts probably would alter land use significantly. The timing of construction and the provision of rail transit are likely to be key factors which would either reinforce or modify conventional real estate dynamics. Incentives for change would be most prominent in those parts of the Corridor where manufacturing uses are subject to increasing pressures for residential redevelopment.

Once the Arterial street became committed, it is probable that developer interest in low valued lands along the waterfront would intensify. Project socio-economic studies indicate that most of the assembled properties would consist of inexpensive industrial firms which can either perform their business in other locations or would be inclined to yield to real estate pressures. In addition, inactive City-owned pier property might stimulate locally oriented re-use proposals. The rail transit component, because it would become operational after the Arterial street system, would stimulate longer range redevelopment interest focusing on areas where large scale projects are possible near station locations. The Arterial with surface bus transit would serve intermediate range development until the rail line was completed.

Historically, New York City and other cities have demonstrated the development attraction of rail transit projects in under-utilized land areas. New York City has several examples where the development was realized, but the transit was not.

Lower Manhattan In Lower Manhattan, the removal of the elevated Highway would permit the development of the planned pedestrian level access system between the business center and the Battery Park City project. Mixing through and local traffic in the same location at grade would be in conflict with the Lower Manhattan Plan. The rail transit component would improve access to Lower Manhattan, acting to reinforce its economic growth and ensure a regional employment base. The proposed transit station at the World Trade Center would also directly benefit the marketability of office developments in Battery Park City and the Washington Street Urban Renewal Area, as well as diversify the transit travel opportunities of the future residential population.

Elimination of the elevated Highway would have no short-range effects on the Holland Tunnel area other than increasing the likelihood of future real estate speculation. This area would probably remain industrial in character, and could absorb some of the low density uses relocated by changes in other areas along the Corridor waterfront. However, long-range pressures for redevelopment are expected to intensify, as with the Maintenance and Reconstruction alternatives.

Greenwich Village Removal of the elevated structure of the existing Highway, coupled with the scheduled removal of several piers in the West Village area, should stimulate additional real estate interest for residential development, particularly in the blocks fronting West Street. Precedents for such westward expansion have already been set by Westbeth and the West Village Housing Project. If this trend gains momentum with the construction of an arterial West Street and service road, property values could be expected to rise and stimulate value increases further upland. Since zoning changes would be required, there would be an opportunity to guide the scale and density of development to correspond with the present character of Greenwich Village. However, orderly growth is difficult to achieve under a speculative situation. The introduction of rapid transit stations at Christopher and 14th Streets would justify greater densities within walking distance of these locations and could subsequently stimulate interest for large waterfront developments both offshore and upland.

While this alternative would not directly disrupt the present operations of the Gansevoort-14th Street Meat Market, removal of the existing elevated Highway and construction of a rail transit station at 14th Street, including the extension of the crosstown Canarsie line, would significantly improve this location's attraction for long-range, large-scale redevelopment. The continuation of the Gansevoort solid waste facilities complex would be an inhibiting factor to redevelopment.

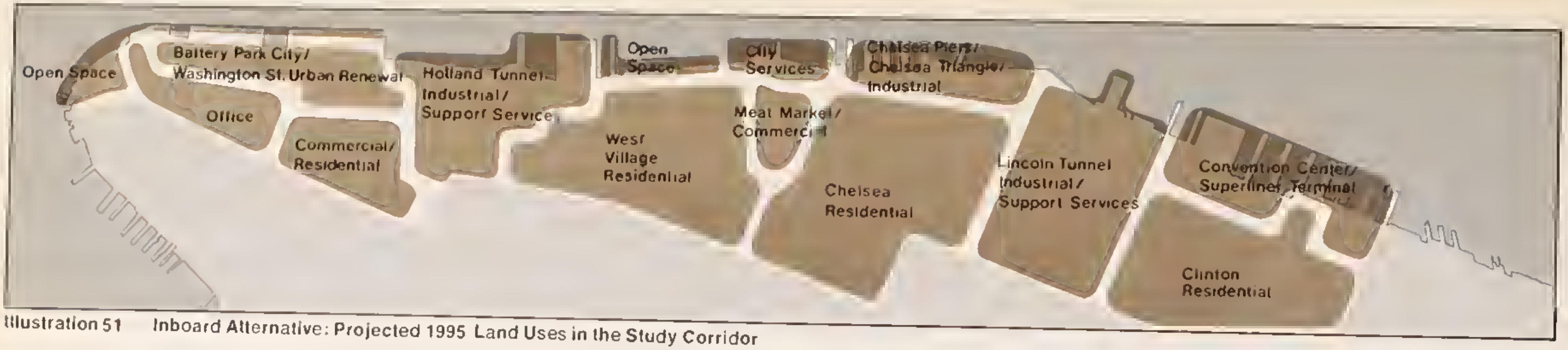


Illustration 51 Inboard Alternative: Projected 1995 Land Uses in the Study Corridor

Assuming long-range redevelopment of the seven-block meat market area with the Arterial with transit alternative, the effects on the West Village community would be mixed. In addition to the physical and functional transformation, population and traffic characteristics of the area would be significantly altered. By increasing the supply of housing, demand in adjoining areas would be moderated and property values of the new development and the tax base would be increased. On the negative side, the elimination of the meat processing industry would erode a significant source of blue-collar employment. Such an event conflicts with short-term objectives of the City, but may be accommodated in the 1980's or 90's.

Chelsea and Clinton The effect of removing the existing Highway and providing a rail transit system with stations at 14th Street and 23rd Street would also stimulate a demand for substantial changes in the use of the Chelsea Triangle area. These changes are more likely to occur as a result of transit improvements than the Arterial street, due to continued use of the inactive Chelsea piers and community objectives to maintain the industrial character of the waterfront. The thrust of redevelopment in response to a transit line would be for residential conversion of marginal industrial property between West Street and Tenth Avenue. While pier related and upland activities in the Triangle area support fewer jobs than the meat market and can relocate, public action may be necessary to keep them in Manhattan, if their location is critical to other CBD economic activities.

The location of a rail transit station at 34th Street and Eleventh Avenue in the center of an area of extensive, unimproved and inexpensive land would create another kind of redevelopment incentive. Much of the 30th Street yards area is presently under the single ownership of the Penn Central Railroad. Proximity to Midtown, coupled with rail, water, major roadway and tunnel linkages suggests the type of development that has become popular in other American and Canadian cities—large scale multiple use developments consisting of a self-contained complex of commercial-office, retail, hotel and residential facilities.

As the Arterial continues north past the proposed Convention Center and Consolidated Passenger Ship Terminal to the Henry Hudson Parkway at 72nd Street, traffic to and from these facilities and the Midtown business district is expected to intensify. The resulting congestion would detract from the viability of both the shipping terminal and the proposed Convention Center. The trend toward commercial and residential development might be slowed, but market forces which already have produced significant changes in the Clinton community would not be reversed. The proposed transit station at 46th Street and Tenth Avenue would also encourage high-rise development of surrounding preassembled property in conflict with existing community goals and the current City policy of stabilizing the neighborhood.

Inboard Alternative

This alternative was designed to preserve as many of the existing waterfront activities and potentially useful structures as possible. It is not expected to greatly accelerate current growth or development trends within the Corridor. Pressures for change would be moderated due to the physical components of the facility and a longer implementation period. In addition, the express bus transit service proposed with this alternative would have less influence on redevelopment in adjacent communities than a rail system since it would be oriented toward serving suburban commuter markets and the high employment office centers. Express busway service to the adjacent communities would be limited.

Lower Manhattan In Lower Manhattan, the physical barrier of the existing Highway would be eliminated, allowing for implementation of the planned elevated pedestrian network connecting major new development projects. However, in contrast to the Arterial, this alternative would also conform to the Lower Manhattan Plan, because it would separate through traffic below grade from local traffic at grade.

This alternative includes a proposed busway station at the World Trade Center to provide improvement in bus transit accessibility to the West Side of Lower Manhattan. This alternative necessitates utilizing subsurface area within and along the eastern boundary of Battery Park City. This would have the negative impact of delaying the completion of that portion of the site until the highway and transitway were completed. Access to and from Battery Park City during construction would be impeded, and the construction might have a negative effect on the marketing of residential units during this period.

The northern parcel of the Washington Street Urban Renewal Area, currently planned for 800 units of housing, would be affected by elevated ramps from the Holland Tunnel interchange double-corridor alternative, reducing this usable development parcel by about one-third. This would not occur with the alternate one-corridor interchange, as described in Section 3. The physical configurations of the interchange ramps, plus improved truck access, would tend to reinforce the use of the Canal Street area by present activities including the important printing and graphic arts businesses, and future goods distribution and municipal service functions. The physical presence of roadway ramps in the area is compatible with such light industrial uses and would help to maintain property values, a necessary condition for achieving a municipal service district.

Greenwich Village The Inboard alternative would significantly enhance the West Village waterfront in terms of public amenities, redevelopment potential and property values. The elimination of the physical barrier effects of elevated roadways, and the existence of a clean and attractive waterfront would create a demand for residential redevelopment of the existing low density industrial properties along West Street. Existing truck terminals and storage areas would disappear from the area and concentrate in underutilized facilities near the Holland Tunnel or north of 14th Street. The length of time required to complete the alternative in this area, and the amount of disruption to the waterfront during the construction period, would moderate the change and provide lead time for the formulation of special development guidelines. As with all previous alternatives, special district zoning or other land-use controls could ensure the extension of West Village character throughout the waterfront area. The limited amount of remaining land resources in the West Village, coupled with the more gradual staging of events, would only slightly relieve the anticipated continual demand on Greenwich Village's existing housing stock.

The meat market area would not be physically impacted by the Inboard alternative and should not attract pressures for deliberate redevelopment as long as it can function economically at its present location. Truck access to and from the market would be improved by highway ramps at 14th Street, and additional parking and loading space would be provided along West Street. These positive effects would facilitate daily operations and reinforce the current status of the area.

Assuming that the market might be discontinued at some point in the future, redevelopment could be anticipated similar to that described under the Arterial alternative, but in a less varied and intensive form. The lack of a public transit station at 14th Street in the alternative would modify redevelopment potential. In addition, even with the elimination of the Gansevoort Destructor plant, the adjacent waterfront could not be used to full advantage because of the configuration of a reconstructed West Street, access ramps to both the highway and the Marine Transfer Station and a ventilation building.

Chelsea and Clinton The Inboard alternative, elevated along the Chelsea waterfront, should produce effects similar to the Reconstruction Alternative. First, it should preserve the Chelsea Piers (58-62), but not assure that existing inactive or underutilized waterfront activities would be revitalized upon completion. Second, it should limit redevelopment options for the adjacent upland blocks. If preserving existing waterfront and industrial activities in the Chelsea Triangle is not accompanied by a long term industrial renewal program, then this alternative would have the effect of continuing to depress property values and perpetuating land uses that could be redeveloped for greater social and economic benefits.

On the other hand, by discontinuing the use of the 14th Street railroad viaduct, this alternative would permit the redevelopment of Tenth Avenue frontages and possibly 23rd Street at a time earlier than the previous alternatives. The relocation of Thomas F. Smith Park and the development of new housing would help to form a buffer between the present upland residential area and the continued low density industrial area along the waterfront. Such a buffer would also tend to alleviate growing residential pressures in Chelsea caused by the conversion of existing housing into more expensive apartments.

The Inboard alternative's effects on the Lincoln Tunnel and 30th Street rail yards area should be similar to its effect upon the Holland Tunnel area. Transportation related activities relocated from other parts of the Corridor would concentrate in the yards where close proximity to Midtown and the combination of water, rail and highway access offer unique opportunities for a municipal support center. Land conservation would be somewhat greater in that the interchange and transit right-of-way would require a reorganization of the rail yards, resulting in additional space for goods distribution and public service developments. Since the yards already accommodate more truck storage activities than rail freight, improved access due to the interchange would solidify this trend, thus increasing the value of the area over the long run and reinforcing present City policy.

As currently planned, the new Inboard highway would connect to the existing Highway at West 43rd Street. Other than anticipated traffic conditions, the new highway would not significantly alter the development potential or character of the Clinton community. Existing and planned projects such as the Consolidated Passenger Ship Terminal, Clinton Urban Renewal Area, and the Convention Center are expected to be the primary influences in the area along with a proposed special zoning district.

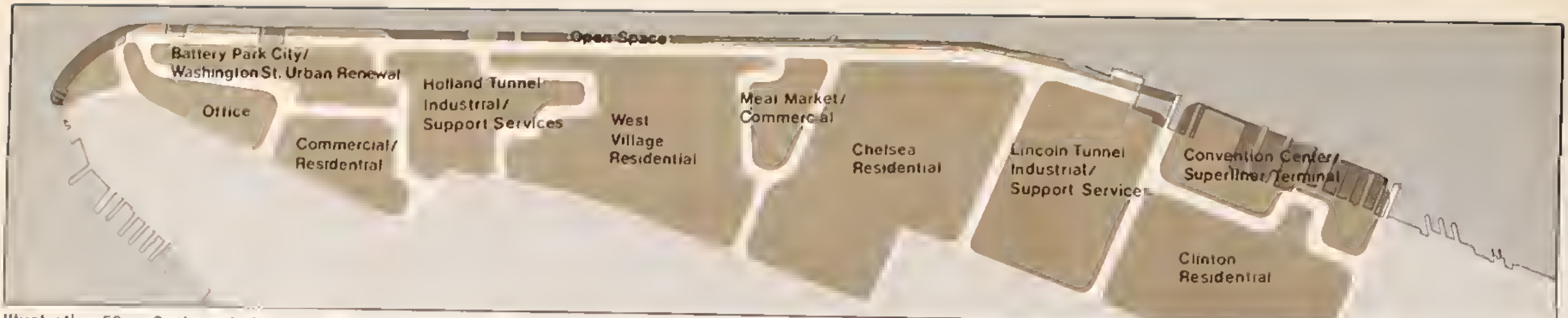

Open Space
Battery Park City/ Washington St. Urban Renewal
Office
Commercial/ Residential
Holland Tunnel Industrial/ Support Services
West Village Residential
Meat Market/ Commercial
Chelsea Residential
Lincoln Tunnel Industrial/ Support Services
Convention Center/ Superliner Terminal
Clinton Residential

Illustration 52 **Outboard Alternative: Projected 1995 Land Uses in the Study Corridor**

Outboard Alternative The Outboard alternative was designed as a catalyst for major physical changes on the West Side. It would encourage present trends more than the Inboard by expanding the range of options for upland redevelopment, and by creating new land along the waterfront which could be used for relieving growth pressures on existing communities. Unlike all other alternatives, the Outboard proposal places heavy emphasis on open space requirements for existing local residents and provides for a continuous strip of park land alongside the River from Battery to 37th Street.

Lower Manhattan The effects of the Outboard alternative are similar to those of the Inboard. West Street would be enhanced in accordance with the Lower Manhattan Plan, and improved access would be provided with a transit station between Battery Park City and the World Trade Center.

Like the Inboard alternative, this proposal would conserve upland areas within the Holland Tunnel double-corridor interchange configuration for existing warehousing, distribution and light manufacturing activities, including printing and graphic arts businesses. The potential use as a municipal service center, as envisioned by the City Planning Commission, would be enhanced. In addition, this alternative would create approximately 60 acres of new land in the off-shore area north of Battery Park City and south of Canal Street. With the exception of a waterfront esplanade at the river-edge, most of this new land would be available for industrial development and municipal services consistent with City policy.

Greenwich Village Along the West Village waterfront, the effects of this alternative on the character of adjacent areas are notably different from the Inboard proposal. First, 54 acres of developable new land would be created between the new highway facility and the bulkhead line. If developed according to Greenwich Village goals, a new population of substantial size and influence, along with housing and public facilities, would be added to the existing West Village community. In addition, a continuous 37-acre park would be provided over the highway and transitway facilities along the shore of the Hudson.

In effect, the creation of new land would establish a new off-shore community with physical, social and political ties to Greenwich Village. The fact that it would be publicly owned land, the use and development for which could be formulated over the next several years—but prior to the completion of the transportation facilities, tends to spread the effects of this alternative over the longest time period of all alternatives. While a long period of deliberation and planning may be a trying experience for the existing community, the West Village's ability to influence public decisions concerning the physical and social characteristics of this new development would in large part determine the ultimate effects of creating new land.

This alternative would not accelerate the decline in existing activities along West Street as rapidly as for the Inboard and Arterial proposals, because such activities could continue during land-filling and construction operations. Incentives for residential expansion into off-shore areas are placed in a long-range perspective with the Outboard alternative. As a result, highway related effects on upland land-use changes would be gradual over the next ten years. By creating off-shore land and more competitive redevelopment conditions, resultant property values in upland areas would increase gradually.

Upon completion of this alternative, upland conditions in the Gansevoort-14th Street Meat Market area would be expected to be similar or improved to what they are today, unless the economics of the meat market itself change over the next ten years. During the Project implementation period, decisions regarding the use and development timing of the off-shore landfill area would be made, the Gansevoort Destructor complex would be relocated, and new highway access would be provided at 14th Street, impacting the meat market. As a result, local circulation is expected to improve, and market trucks would be able to utilize the new highway. Actual construction on the newly created off-shore land would then begin to influence the ultimate reuse potential of the meat market area.

Chelsea and Clinton Future redevelopment changes in the Chelsea Triangle would also take place over a longer period of time and would be dependent upon the final determination of the use and development of the off-shore land fill. About 25 acres of this new landfill site could accommodate either industrial or residential uses, while an additional 22 acres would be designated for riverfront park space. If it were decided that the new landfill between the Outboard and the bulkhead line be developed for residential purposes, the adjacent existing upland area would soon follow because of its inexpensive land and easily relocated low job density businesses. The growing demand for housing in Chelsea, coupled with the elimination of the Chelsea Piers (58-62), would probably stimulate early movements for residential conversion along the west side of Tenth Avenue, immediately adjacent to existing neighborhoods, and possibly along 23rd Street. This redevelopment would be further encouraged by the termination of the 14th Street railroad viaduct.

Unlike the Greenwich Village situation, the type, character and intensity of development on new land in Chelsea is not automatically bound to that of existing upland areas. Although real estate pressures for redevelopment are increasing and residential conversion is likely, land use in either the Chelsea Triangle or on off-shore landfill would depend more on evolving City policy for these areas. A similar situation exists in regard to the Chessie System railroad yard fronting on West Street-Twelfth Avenue between 24th and 26th Streets. The potential for redevelopment of this and other undeveloped sites in the area is high, yet City policy and economic requirements of the Manhattan economic base will be deciding factors.

Except for the availability of 38 acres of additional off-shore land, the future character of the 30th Street railroad yards and the Lincoln Tunnel interchange area would not be greatly different from that for the Inboard alternative. Reorganization of the yards would preserve land resources for goods distribution and municipal services developments in line with City objectives for the area. However, creation of new land in the off-shore area would reinforce these objectives by reducing real estate pressures on the upland area and maintaining property values at a level conducive to distribution and service oriented activities. Effects on the Clinton community would also be very similar to those discussed with the Inboard alternative.

Saint Joseph's Church, south of the World Trade Center in Lower Manhattan, is adjacent to the existing West Side Highway.

Summary Comparison

The Maintenance and Reconstruction alternatives would stimulate no highway related redevelopment, and would initiate few positive effects on adjacent communities. By reinforcing existing land uses on the West Side and precluding positive land-use changes far into the future, those alternatives would likely produce counter-productive effects for both adjacent communities and the City alike.

The Arterial alternative offers rapid implementation of a new roadway, followed by a more lengthy period for rail transit construction. It would enhance the marketability of the Battery Park City project and would stimulate early speculation and redevelopment along the West Village waterfront. Pressures for substantial change both off-shore and upland would be intensified by the rail transit development, especially at station locations and in the meat market area. Development initiatives from the private sector would mandate significant public involvement within the next ten years, in order to moderate the timing and intensity of change affecting predominantly privately owned areas.

The Inboard proposal anticipates the development of a project over a ten-year period. Preservation of existing land uses and facilities would be the primary guideline, with redevelopment focused on the narrow strip of land adjacent to the existing facility. Rapid speculative change would be less intensive than in the Arterial alternative, allowing for both City and community involvement in the development process. Development of new land resources would be limited to recreation space utilizing a covered section of the new facility along the West Village.

The Outboard alternative would have the effect of spreading future changes over a longer period of time, beyond the ten year construction period, and focusing redevelopment energies on newly created off-shore land rather than adjacent upland areas. Both public and private commitments to such an extensive redevelopment proposal would be large, but the longer lead time provided would allow for the formulation of community oriented control mechanisms and an orderly development program. The potential for new housing in off-shore areas could be used to moderate demand in adjacent communities and relieve pressures for residential expansion into those industrial areas that the City is attempting to stabilize. Extensive open space is another resource which could be developed for the benefit of local communities. Although long-term in nature, the Outboard alternative would create conditions that stimulate extensive, deliberate changes as distinct from the less controlled and largely deteriorating changes of the Maintenance and Reconstruction alternatives, the speculative conditions of the Arterial alternative, and the limited changes of the Inboard alternative.

Other Economic Effects

Short-Term Employment

The actual construction expenditures that would be required for any of the alternatives would generate jobs and wages in the New York Region. The Project alternatives vary greatly in cost and complexity so that on-site and off-site related employment would have different magnitudes of impact on the West Side, Manhattan and the New York metropolitan area.
The alternatives, including all the options and ways in which they can be put together in different combinations, result in a wide range of costs and periods of construction. In order to simplify estimates of construction impacts on employment, the costs of the alternatives only south of the Lincoln Tunnel Project limits have been estimated for the Inboard and Outboard alternatives, both with transitways, and from the Battery to 72nd Street for the Maintenance, Reconstruction and Arterial alternatives.
The Arterial alternative estimate of employment includes the assumption that a rail transit facility will be included.

Table 35 **Impact of Construction on Employment and Regional Income**
In millions of dollars

Alternative	Construction Cost	Number of Jobs Created(c)	Total Wages	Regional Income
Maintenance(a)	$ 86	1,200	$ 25	$ 75
Reconstruction(a)	227	3,500	65	200
Arterial(a)	307	4,000	90	270
Inboard(b)	1,111	15,000	315	950
Outboard(b)	1,415	20,000	400	1200

(a) Based on construction to 72nd Street.

(b) Based on construction to 42nd Street, including transit system construction, without right of way costs, to 42nd Street.

(c) In man-years, one man working one year.

Employment generated by the construction of each of the alternatives has been estimated only in terms of on-site construction jobs. Estimates do not include construction activity associated with the development of new land created by some alternatives, since it is assumed that such development would occur somewhere in the metropolitan area anyway. Related off-site employment gains would occur in direct relation to the scale of construction. Although there would be some variance related to the type of construction system being used, it has been assumed that jobs created would be proportional to the total cost of the alternative.

The impact of the construction expenditures for each option can be related to the City economy through the use of a "multiplier." Thus, it is assumed that one dollar of exogenous expenditures in the City (or the Region) generates additional expenditures, wages and profits in other sections of the economy. Contemporary economic studies indicate that the value of the multiplier (that is, income generated per dollar of exogenous expenditure) is proportional to the size of the metropolitan region in which a project is located.

In general, the larger the metropolitan area, the higher the multiplier. Multiplier figures range from 2.0 for small metropolitan areas to 3.2 for larger areas. Since the New York City metropolitan area is the largest and most diverse in the country, it has been conservatively assumed that the area has an effective multiplier value of at least 3.0. On this basis, the accumulated regional income that would be generated by the alternatives would range from $75,000,000 for the Maintenance alternative to $1,200,000,000 for the Outboard. (See Table 35.)

Highway User Cost Savings

The alternative plans would have significant impacts on vehicle travel patterns within Manhattan. One method of comparing the effects of the Project alternatives is in terms of their impacts on the cost of driving on Manhattan streets. Additionally, improved access to and from the CBD would be a benefit accruing from the construction of either of the two transit proposals. Moreover, diverting some people from the Highway to the transitway would reduce the travel costs of those vehicles remaining on the Manhattan street system.

Differences in operating costs of motor vehicles can be expressed in dollars by measuring savings in the costs of operating vehicles, the value of the reduced time spent in making trips, and savings due to the reduction of accidents resulting from less congestion and better operating conditions.[57] Differences in the costs of operating vehicles were measured throughout Manhattan in order to account for improved conditions attributable to shifts in travel patterns all over the Island. The majority of Manhattan's jobs and businesses which rely heavily on the support services provided by trucks and taxis are located in the CBD. Approximately 75 percent of the miles traveled by vehicles in the CBD are made by taxis and trucks. Hence, comparing the effects of the alternatives on highway user costs within that portion of the Island provides an indication of some of the changes primarily associated with business activities resulting from each alternative.

The Manhattan highway system user cost savings for the Reconstruction and Arterial alternatives would be small in comparison with those of the Inboard and Outboard. Because the Arterial highway would provide only a slight improvement to the highway network, the annual savings shown for the Arterial would be primarily the result of diverting highway trips to the transitway associated with the Arterial. These savings would be distributed throughout the Island, with more than three-quarters of these savings occurring outside the CBD. (See Table 36.)

Annual highway user savings with the Inboard and Outboard alternatives would be attributable to both the diversion of trips to the transitway and the improvements in the highway system resulting from a reconstructed West Side Highway. These savings would be more directly attributable to the highway reconstruction and would be heavily concentrated in the CBD.

Table 36 **1995 Annual Highway User Costs and Savings**

Alternative(a)	Manhattan User Costs(b)	CBD User Cost Savings	Non CBD User Cost Savings	Total User Cost Savings
Maintenance	$1,304,787,000	–	–	–
Reconstruction	1,278,552,000	$23,859,000	$2,376,000	$26,235,000
Arterial	1,290,630,000	3,498,000	10,659,000	14,157,000
Inboard	1,215,291,000	69,597,000	19,899,000	89,496,000
Outboard	1,218,327,000	67,155,000	19,305,000	86,460,000

(a) Maintenance and Reconstruction user costs calculated for 1995 "BMN" trip tables, without transitway. Arterial, Inboard and Outboard user costs calculated from 1995 "BMB" trip tables, with bus transitway. See Project technical reports on traffic forecasting.

(b) Maintenance, Reconstruction and Arterial extend from the Battery to 72nd Street. Inboard and Outboard extend from the Battery to 42nd Street.

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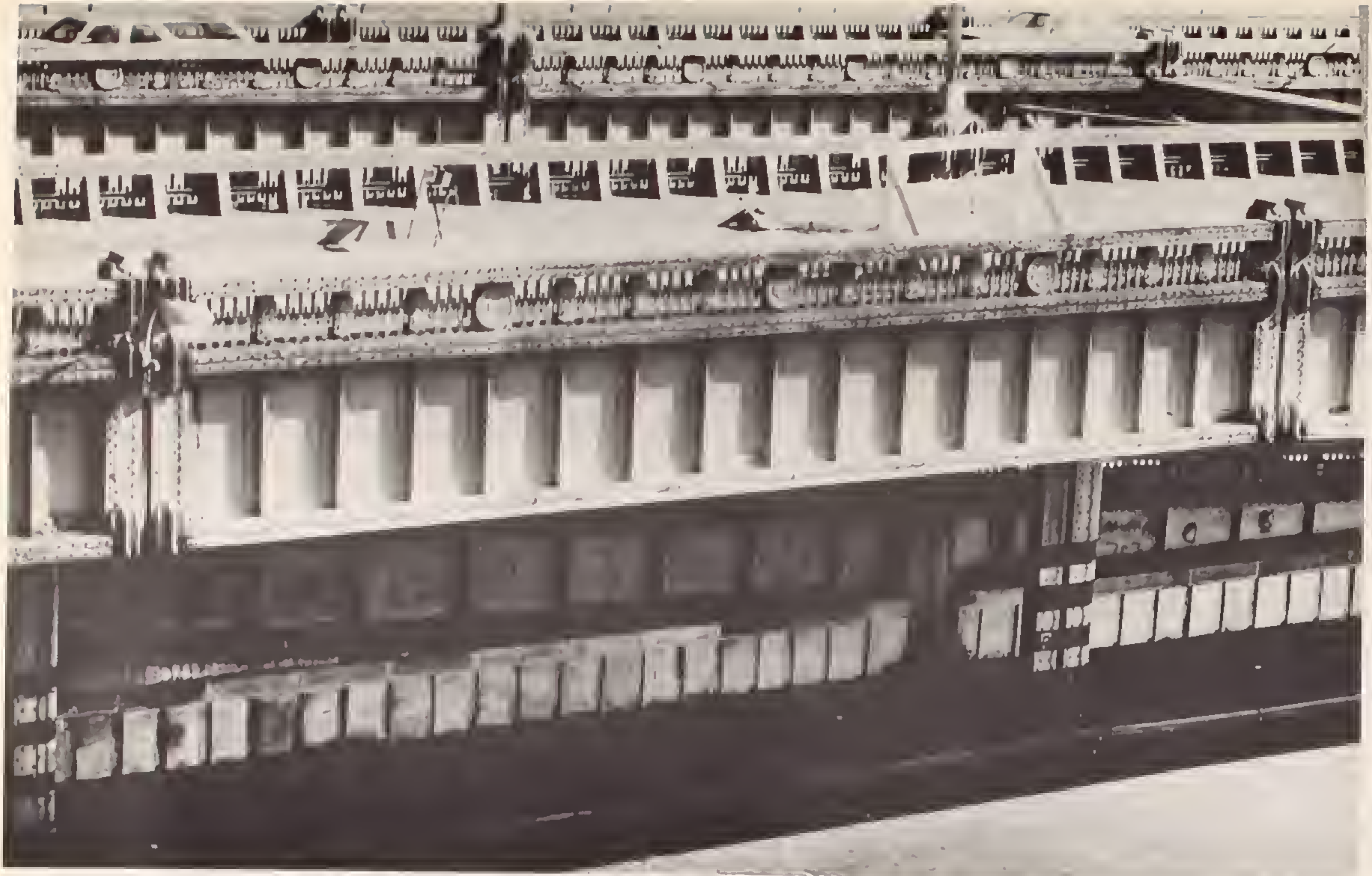
[57] Full discussion of the derivation of dollar values for those components of "user costs" can be found in *Documentation of Time Accident and Vehicle Operating Costs for the West Side Highway Project*, April 17, 1973.



In the West Village area, a resident sunbathes on a section of the existing Highway closed for repairs last Fall.

Parks And Waterfront Access

Adequate open space and recreation facilities are essential to improving the quality of life in an area which is as densely developed as Manhattan. The West Side Highway Project presents opportunities for improvement in the amount, quality and distribution of open space, recreation facilities and waterfront access on the West Side.

The conversion of commercial properties in Greenwich Village and Soho to residential use, and new residential construction in several areas of the Corridor continues to add people to sections of Manhattan already significantly deficient in public open space. The thrust of this residential growth is toward the waterfront, and in a few cases is immediately adjacent to the existing Highway.

The potential role of a reconstructed West Side Highway in enhancing the potential of the Hudson River waterfront was recognized by the Steering Committee in two policy statements:

- **Recognize that existing waterfront usage as well as revitalization of the West Side waterfront area is an essential consideration in planning and design of the reconstructed facility.**

- **Recognize that development and presentation of substantial public access to the waterfront is a principal ingredient in the formulation of alternative corridor plans.**

Existing Park Lands

Parks in Manhattan

New York City today has an impressive inventory of public open space. Over 38,000 acres of publicly-owned open space are used for recreation, amounting to 18 percent of the total area of the City. In planning for existing and future recreation needs in the City, the problem is not so much the amount of open space, but rather its distribution. Nine of the 62 Community Planning Districts in the City contain over 54 percent of the total available public open space. Manhattan below 60th Street contains one-third of the borough's population, but only one-twelfth of its total public open space.

Determination of the proper amount of open space for a community has generally been expressed in the number of acres of park per thousand people, though no firm standard has ever achieved broad-based

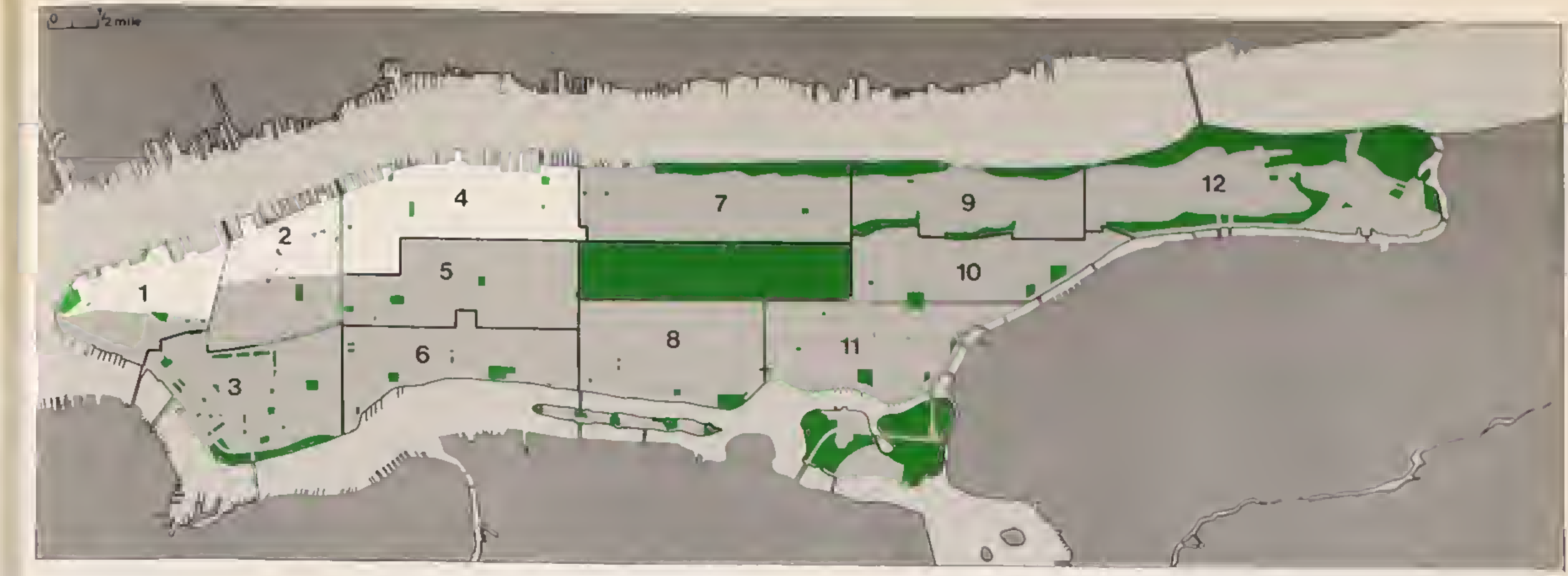


Illustration 53 Existing Park and Recreation Areas in Manhattan Community Planning Districts

🟩 Existing Park and Recreation Areas

⬜ Project Study Corridor

North

support. Currently, the average ratio of recreational open space for Manhattan is 1.42 acres for every thousand residents. This compares with a ratio of 1.2 to 2.0 acres per thousand residents recommended by the American Public Health Association for areas in which multi-family dwelling units are located. The Regional Plan Association (RPA) has recommended for each community in Manhattan a minimum standard of 0.6 acres per thousand residents. This figure is somewhat low compared to other guidelines and reflects the high residential density peculiar to Manhattan and the geographic limits of the Island, both of which must be taken into account in suggesting a reasonable and achievable standard.

Although the Manhattan average ratio of 1.42 acres per thousand residents is more than twice the RPA suggested level, the distribution of that recreational acreage is extremely uneven. If the ratio of open space to population is broken down by Community Planning Districts and compared, it becomes apparent that, with the exception of Community Planning Districts One and Five, which have low residential populations, the Planning Districts south of 60th Street are those with the lowest ratios in Manhattan. The high ratios for Districts north of 60th Street are due primarily to the acreage represented by Inwood Hill, Fort Washington, Riverside, High Bridge and Central Parks. Community Planning Districts Two and Four, which include the Hudson River waterfront between Canal and West 60th Streets, have especially low ratios of 0.36 and 0.22 respectively.

Given these low open-space ratios and the projected future growth of residential population along the Hudson River waterfront, this Project has placed emphasis on the development of alternatives which would help alleviate the existing lack of recreational open space south of 60th Street, especially within those portions of Community Planning Districts One, Two, and Four most directly affected by the alternatives.

Parks in the Study Corridor

There are 39.06 acres of parks and playgrounds in the Project Study Corridor. Like other sections of Manhattan, the study area contains a number of small parks and playgrounds for purely local use. Over twenty facilities, most of them less than one acre in size, fall into this category.

Battery Park provides more than half of the Corridor's park acreage. Located at the tip of Manhattan, it is well removed from existing residential concentrations. However, it is heavily used during the day by office workers employed in Lower Manhattan.

Public open space and access to the edge of the River between Lower Manhattan and Midtown is currently limited to Battery Park, Waterside Park and the Morton Street Pier. The rest of the waterfront, once a thriving center of maritime activities, has changed considerably over the past decade. Only the Circle Line and Pier 40 continue to function as maritime facilities between Battery Park and 42nd Street. Many piers are in an advanced state of deterioration, and most are used for non-maritime related activities.

Lower Manhattan In terms of land use, the Community Planning District One portion of the Corridor is devoted almost exclusively to office, commercial and light industrial activities. The only sizeable open space in the area is the 23-acre Battery Park, which provides 97 percent of the open space within this portion of the Study Corridor. Other public open space, such as the Trinity Church grounds and plazas in front of commercial buildings, function as lunch-time recreation areas for the mid-day crowds of office workers.

When completed, Battery Park City will add 26 acres of open space as a complement to its 15,000 residential units. The adequacy of current open space available for public use is difficult to measure by conventional standards because of the low number of residents, but there is very high use by thousands from the business community during the lunch hour. In the summer months, the area is also visited by great numbers of tourists who add further to the crowding of Battery Park and other public space in the area.

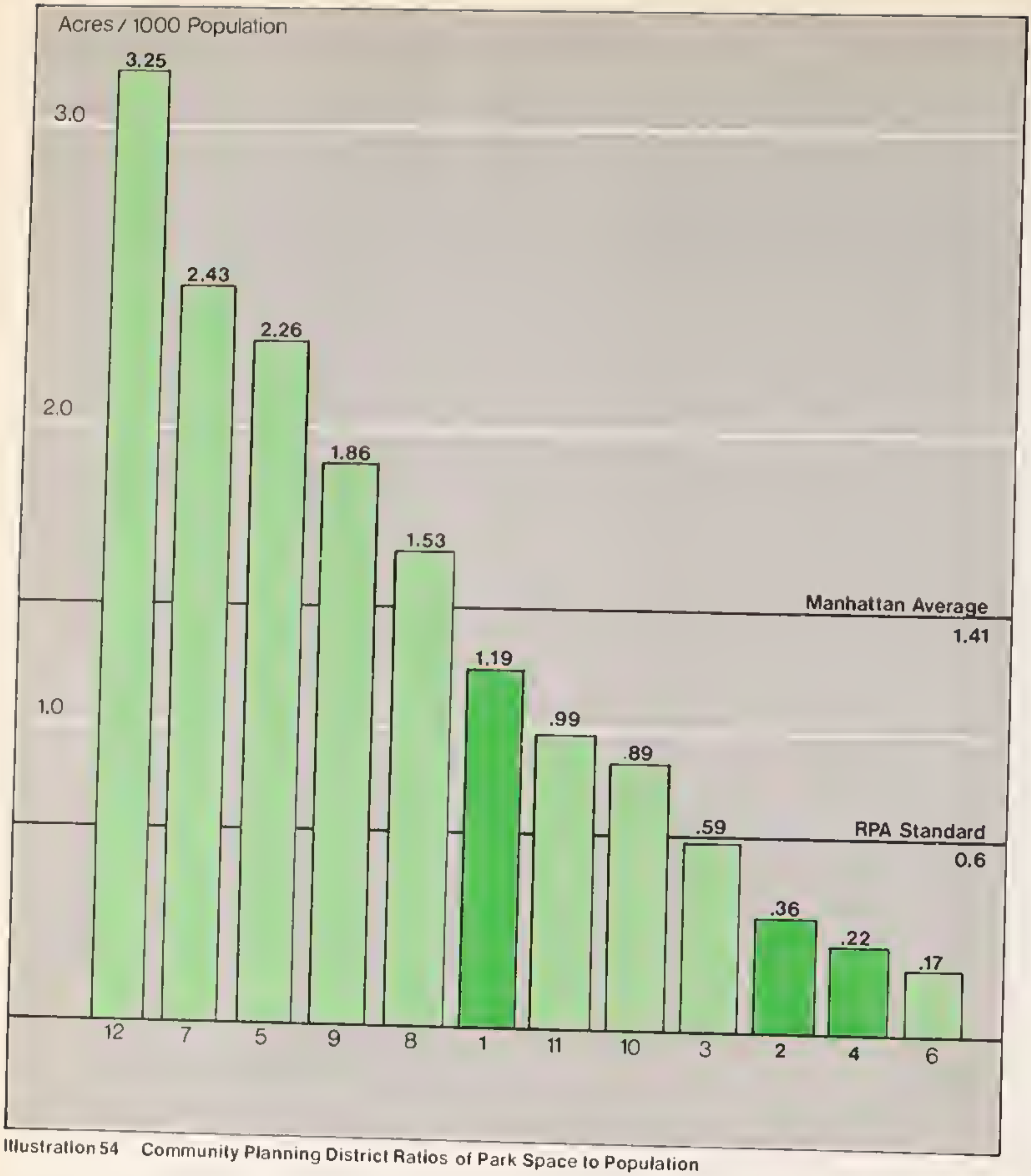


Illustration 54 Community Planning District Ratios of Park Space to Population

Greenwich Village The portion of Community Planning District Two which lies within the Study Corridor contains a residential population of 37,485. Land use in the area is predominantly residential, but to the west of Washington Street, uses are a varied mixture of commercial, light industrial and residential. Local open space and recreation facilities within this area total only 7.8 acres. Using the RPA standard of 0.6 acres per thousand residents, existing open space serves adequately only one-third of the area's population.

The community has already turned to the waterfront area to meet its need for more open space. The first such official effort was to secure access to an unused pier at Morton Street. Pier 42 was opened to the public after the shed was torn down in 1966. In addition, a small strip park was established within the area originally occupied by the headhouse. There are further plans for the utilization of piers in this area, and the City Department of Parks recently noted that it has "combed every available piece of park property and finds that there is simply no appropriate place to develop a new site" for tennis courts on the West Side below Midtown, except on the vacant Pier 49. (Letter dated October 5, 1973, Deputy Administrator, PRCA, to Deputy Administrator, Department of Ports and Terminals.)

In order to meet the RPA minimum standard of 0.6 acres per thousand residents in this Greenwich Village area, an additional 14.73 acres would have to be developed. To bring the area up to the Manhattan average ratio of 1.42 acres per thousand residents, an additional 45.13 acres would have to be provided.

Chelsea and Clinton The Chelsea and Clinton neighborhoods of Community Planning District Four have the largest residential population and the smallest amount of open space in the Corridor. There are 7.75 acres of open space contained in small parks and playgrounds which serve a population of 46,401. The location and condition of many of the facilities render them virtually unusable. For example, Thomas F. Smith Park (1.86 acres) was until recently leased by the Parks Department to a construction company for the storage of heavy equipment. Unlike the residents of the Village to the south, the residents of this area have not had the opportunity to expand their recreational activities to the waterfront, since few of the piers in the area have been totally abandoned.

The open space in Chelsea and Clinton represents a ratio of 0.17 acres per thousand residents. An additional 20.1 acres of parkland would be required to bring this area up to the minimum standard. In order to bring the area up to the Manhattan average ratio of 1.42, an additional 57.65 acres would be needed.

The relationship between transportation and the development of park and open space has a long history in this country, with some of the most notable examples in New York City. The waterfront esplanades of the United Nations Plaza, Carl Shurz Park and the Brooklyn Esplanade are imaginative integrations of open space, transportation and adjacent land uses. The landfill that doubled the size of Riverside Park with the excavated material from the construction of the Eighth Avenue IND subway, coupled with the covering over of the Penn Central railroad tracks and construction of the Henry Hudson Parkway, is a significant example of coordination of transportation public works to create waterfront parkland and amenities.

The West Side Highway Project design alternatives offer, in varying degrees, other similar opportunities for innovative implementation of a coordinated land use and transportation plan. This discussion will focus on how each alternative enhances or impairs the opportunity to create more open space, parks and recreational lands.

Maintenance

The Maintenance alternative, which would merely repair the existing West Side Highway so that it could be reopened to automobile traffic, would itself do nothing to modify the waterfront or add to the supply of public open space within the Study Corridor. Though land-use changes can be expected to occur over the next 20 years, there is no way of determining whether they would reduce the open space shortage in the Study Corridor. While the transition from commercial and industrial uses to residential use is forecast, it is anticipated, based on present New York City zoning requirements, that only Battery Park City and the Washington Street Urban Renewal Area will provide land specifically designed for public open space. With increased population forecast, it can be expected that more people will be competing for nearly the same amount of open space that existed in 1974, thus further limiting the recreation opportunities available.

Based on the Project 1995 population projections of minimum growth, only Community Planning District One, with an estimated 1.05 acres of public open space per thousand residents, would satisfy the Regional Plan Association's recommended minimum standard of 0.6. Planning Districts Two and Four would have approximate ratios of 0.21 and 0.18 acres per thousand people, respectively.

Though extensive recreational use of the waterfront would be a natural continuum of this residential change and would enhance the lives of West Side residents, the Maintenance alternative would not provide for such conversion. While some decaying piers would be torn down as they became structurally unsafe or accidentally burned, there would be only one pier available for recreation, unless other piers were converted by the City. The waterfront would continue to be dominated by deteriorated piers and headhouses used for trucking and warehousing functions. As a result, the Hudson River would remain largely inaccessible to most West Siders between Midtown and the Battery.

Not only is access to the waterfront important, but the context in which it is provided significantly influences the satisfaction derived from a visit to the River. Access in places specifically designed for recreation, and connected to upland areas by pedestrian-ways would be very pleasant, but the Maintenance alternative would not change the present access patterns, leaving the public an opportunity to get to the water only in Battery Park, Battery Park City, the Morton Street Pier and Waterside Park, and the few additional areas where piers have been or would be torn down. These areas would provide access over a discontinuous north-south distance of approximately 1.4 miles, mostly in Battery Park and Battery Park City. Moreover, east-west access from upland areas directly to the River for pedestrians and cyclists would be limited to Battery Park, Battery Park City at Battery Place, Rector, Liberty, Vesey and Chambers Streets and the Morton Street Pier. Thus, the Chelsea and Clinton neighborhoods would remain without any direct public access to the waterfront, since most piers in their areas have not been totally abandoned.

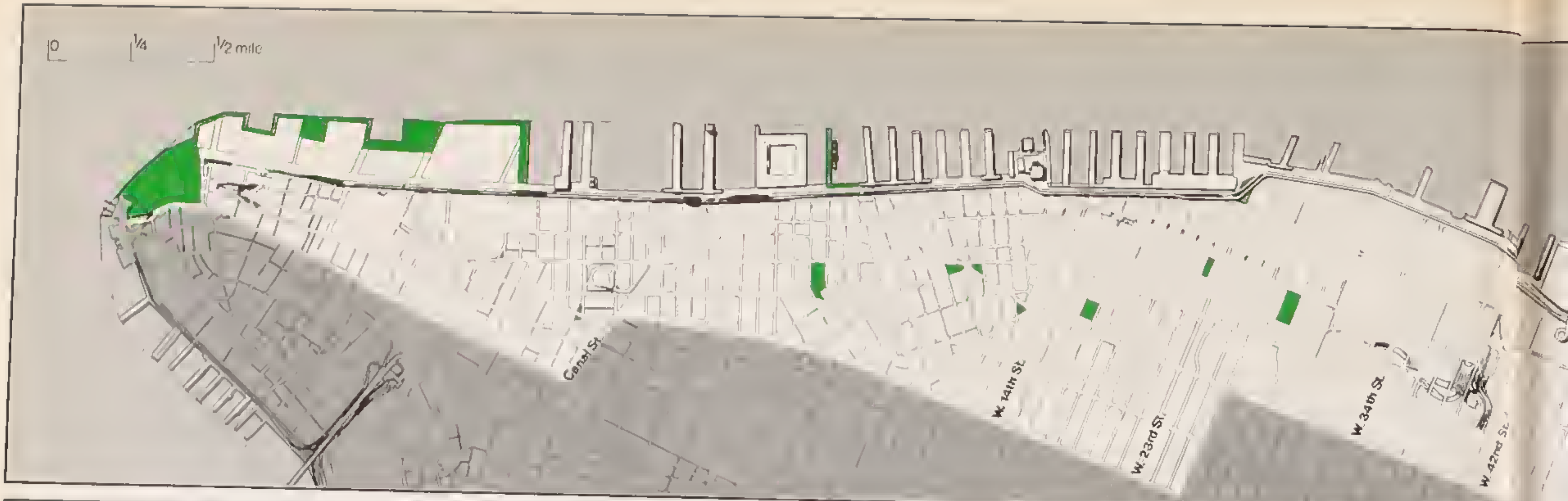
In summary, the Maintenance alternative would undertake no action which would in any way physically alter the West Side of Manhattan. No new park lands or waterfront access would be created by this alternative, and the existing West Side Highway and pier headhouses would continue to inhibit access to the water. With the addition of many new residents to the Study Corridor, an already inadequate open space situation would become more severe.

Reconstruction

The Reconstruction alternative would have essentially the same impact on public open space and access to the waterfront as the Maintenance alternative, with one exception. Southbound off-ramps and northbound on-ramps near West 23rd and West Streets would displace the Thomas F. Smith Park, as discussed fully in the **Section 4(f) Statement on Park Lands**. If Federal Funds were used for this alternative, then the Park would be replaced at another site. If State or City funds were used, park replacement would be optional, as such replacement is not required by either State or City law. If replacement of Smith Park were not required, the total amount of public open space in Community Planning District Four would be reduced by 1.85 acres, dropping its public open space ratio to 0.13 acres per thousand residents. Like the Maintenance alternative, the Reconstruction alternative would do nothing to relieve the shortage of open space, or to enhance the waterfront as a recreation resource.

Arterial

This alternative would remove the existing elevated West Side Highway and create an at-grade high capacity arterial street occupying the entire 250 foot width of West Street and the existing Highway. The Arterial would allow completion of the pedestrian bridges planned to connect Battery Park City to Lower Manhattan over West Street at an elevation of plus 30 feet. These bridges would provide pedestrian access to the waterfront parks and esplanade of Battery Park City from Lower Manhattan.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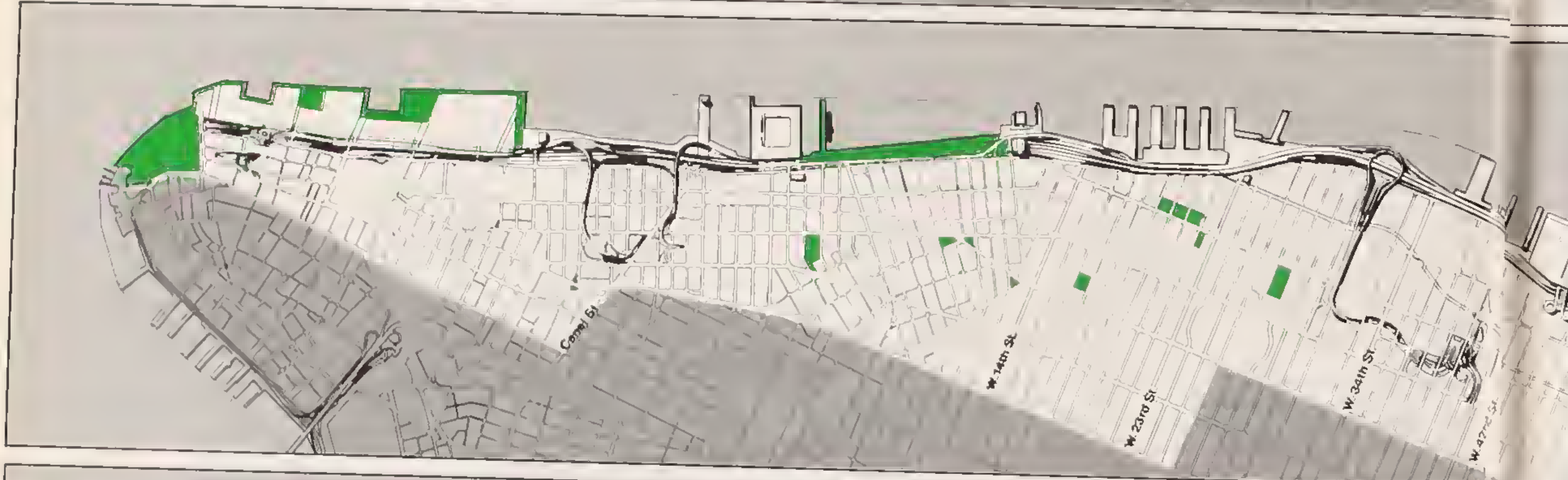
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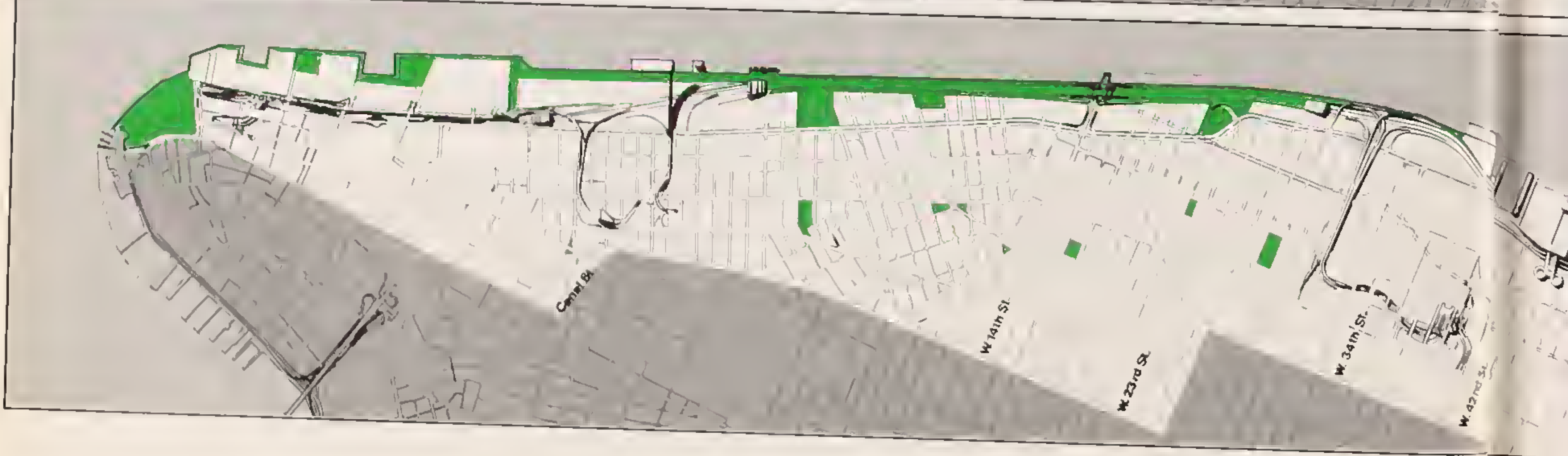
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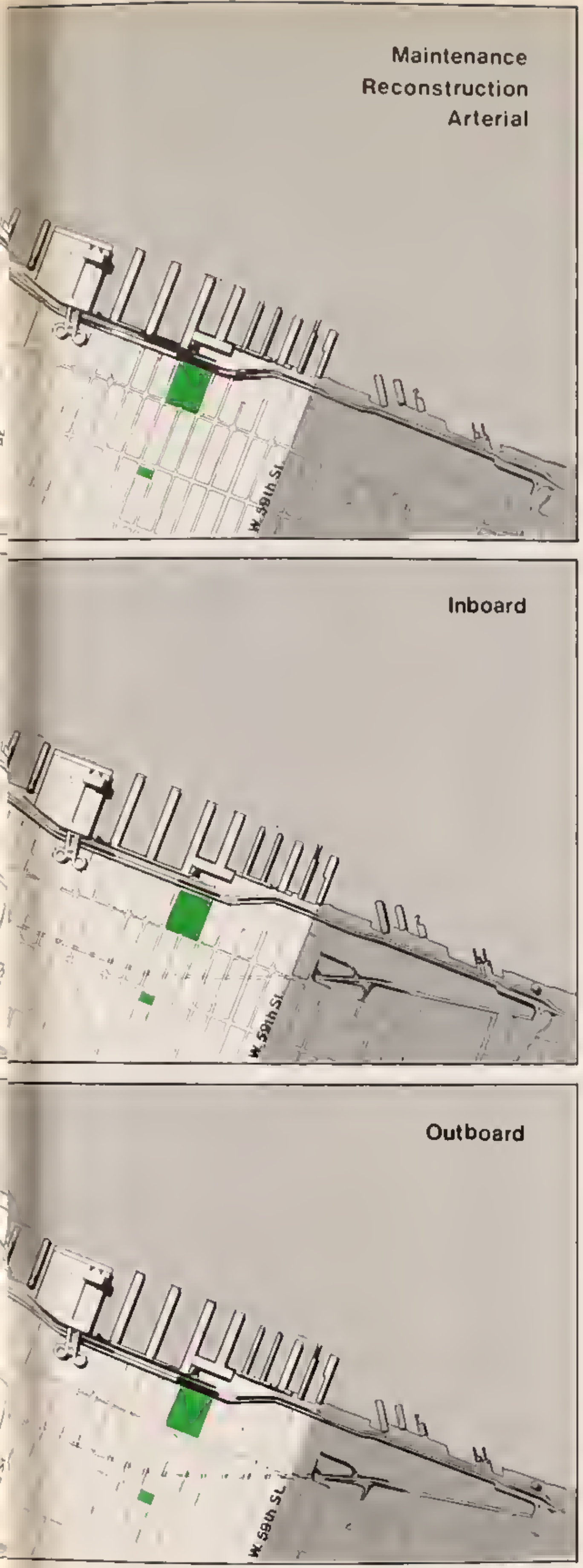


Illustration 55 Park and Open Space Proposals for the Project Alternatives

🟩 Park Areas

North

Within Community Planning Districts One and Two, a 50-foot wide strip of land between the easternmost curb of the Arterial and the existing building line on West Street would be provided as a buffer. In Lower Manhattan, 1.95 acres would be added in the blocks between Hubert and Murray Streets along the Washington Street Urban Renewal Area site. An additional 0.86 acres would be added to the West Village in the blocks between Bank and Bethune, Christopher and Barrow, and Morton and Barrow Streets, where residential uses currently exist along West Street. Though not official public open space, this land could most likely be used by the public.

The length of the waterfront accessible to the public would remain unchanged from the Maintenance alternative, a discontinuous north-south distance of approximately 1.4 miles. Virtually all of this access would be in Lower Manhattan. The Arterial would also be identical to the Maintenance and Reconstruction alternatives by limiting pedestrian access to the waterfront, above Lower Manhattan, to the Morton Street pier and the few additional areas where piers have been or would be torn down. Also, as with the Maintenance and Reconstruction alternatives, Community Board Two would not be assisted directly in achieving its goal of making half of waterfront acreage into open space.

Inboard

Unlike the Maintenance, Reconstruction and Arterial alternatives, the Inboard alternative would undertake actions which would, in many areas, alter the physical configuration and usage of the Hudson River waterfront. By depressing and partially covering the new highway in the vicinity of Battery Park City, and totally covering it along the West Village waterfront, an entirely new urban environment would be created in this part of the Study Corridor. Thirty-two hundred lineal feet of new waterfront esplanade would increase total north-south public waterfront access to 1.9 miles. In addition, people would also find it much easier to get to the waterfront. New east-west pedestrian access directly to public open space would be available at Leroy, Christopher, West 10th, Charles, Perry, West 11th, Bank, Bethune, West 12th, Jane, Horatio and Gansevoort Streets.

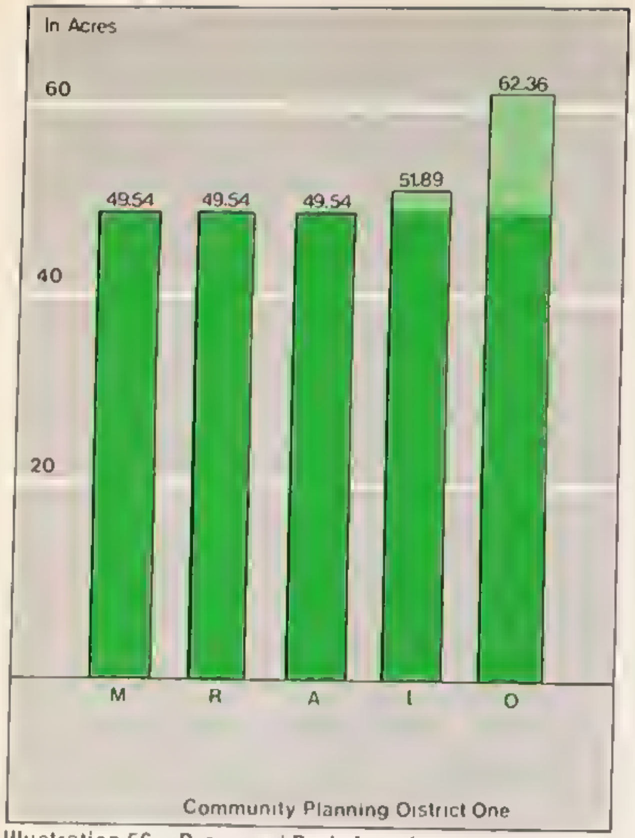


Illustration 56 **Proposed Park Area for Lower Manhattan** (a)

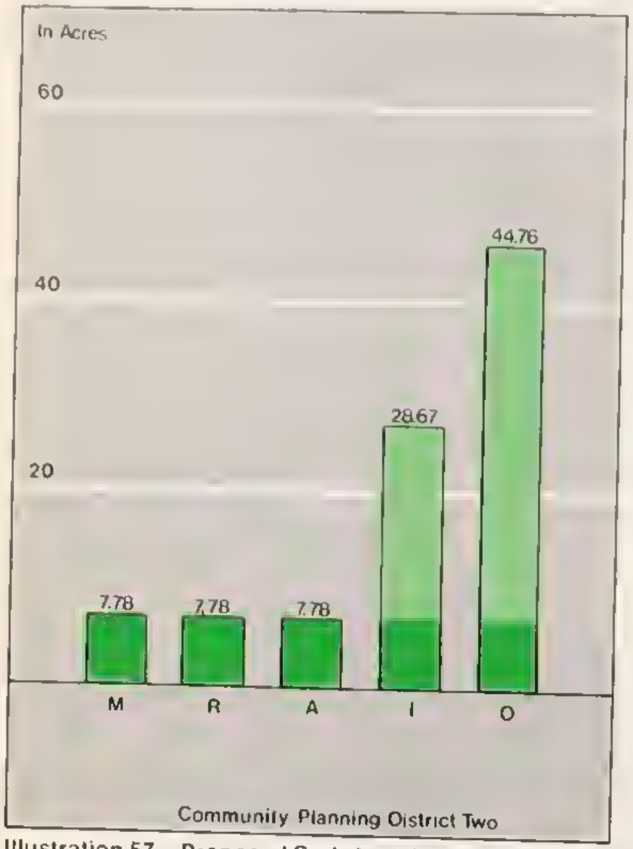


Illustration 57 **Proposed Park Area for Greenwich Village** (a)

In Lower Manhattan, the Inboard alternative would enable construction of the planned pedestrian circulation system connecting Battery Park City and upland areas, though no new public open space would be created. The bridges would enable Washington Street Urban Renewal Area residents to more easily walk or cycle to the riverfront in Battery Park and Battery Park City.

The area above the covered section of the highway and transitway in Planning District Two would add nearly 21 acres of new waterfront parkland, all of it close to the West Village between Pier 40 and the Gansevoort Marine Transfer Station. The waterfront would be cleared of piers, with the exception of the Morton Street Pier, which would be rebuilt and maintained as a recreational pier. This land would raise the District Two public open space ratio to approximately 0.79 acres per thousand residents—nearly four times as much open space as the Maintenance, Reconstruction and Arterial alternatives would provide.

The 21 acres of open space created along the waterfront in the West Village area would assist Community Board Two in achieving its goals for waterfront development. This linear waterfront park would be of approximately the same scale as Carl Schurz Park, and would be designed and landscaped to satisfy the needs of the adjacent communities. The final design of the park land would reflect the cooperative efforts of many different groups, including but not limited to the New York City Department of Parks, Recreation and Cultural Affairs, West Village neighborhoods, the New York State Department of Transportation and the Federal Highway Administration.

Community Planning District Four, which in 1974 has the largest residential population and the smallest amount of open space in the Study Corridor, would receive an additional 0.37 acres from the replacement of Thomas F. Smith Park, as described in the **Section 4(f) Statement on Park Lands**. The replacement park would be located west of Tenth Avenue between 18th and 21st Streets on parcels approximately 150 feet deep. This park relocation site was developed in consultation with the Parks Committee of Community Board Four. Although the replacement park would be in a more accessible location than the present one, the Chelsea and Clinton neighborhoods would remain significantly deficient of parkland and recreational opportunities, particularly at the waterfront, where the Chelsea Piers and most of the other piers in this area would remain in place. There would be only about 0.19 acres of public open space per thousand residents, based upon the minimum growth projection. This is well below the minimum standard of 0.60 called for by the Regional Plan Association.

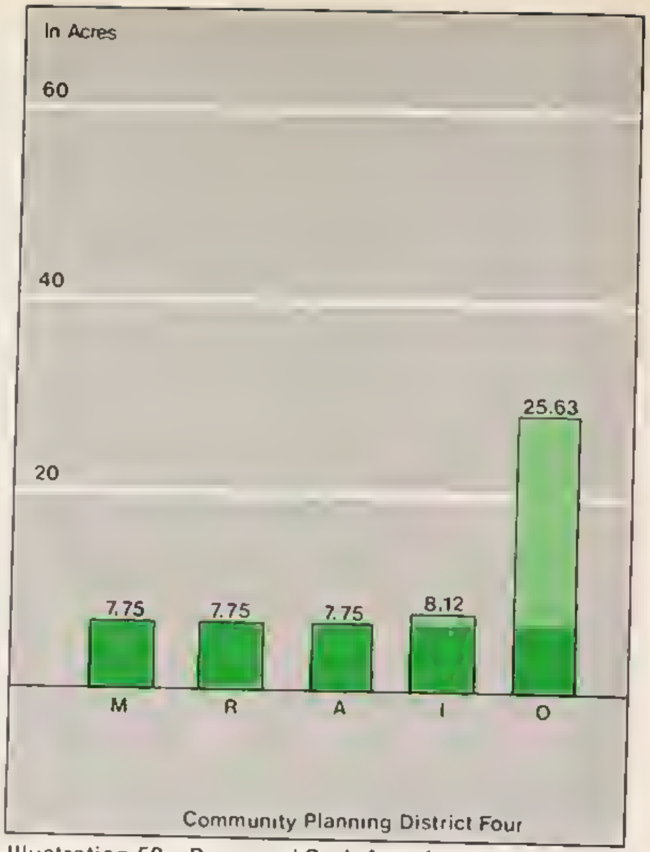


Illustration 58 **Proposed Park Area for Chelsea and Clinton** (a)

(a) M: Maintenance Alternative
R: Reconstruction Alternative
A: Arterial Alternative
I: Inboard Alternative
O: Outboard Alternative

Outboard

The Outboard alternative would extensively alter the Hudson River waterfront south of 42nd Street by using landfill to extend the shoreline to within approximately 160 feet of the United States Pierhead Line, thus eliminating all piers between the northern boundary of Battery Park City and 38th Street. Not only would the shape of the waterfront be dramatically altered and improved, but its function and accessibility would be improved as well. An entirely new relationship would be established between residents of the Study Corridor and the Hudson River. The Outboard alternative, by removing the piers and headhouses which presently block public access to the water, would provide the growing West Side population with a continuous waterfront park all the way from the Battery to Midtown.

Approximately 200 acres of new land would be created—80 of which would become public park land along the waterfront. People would be able to walk or cycle next to the water continuously from the Staten Island Ferry Terminal to West 42nd Street—an uninterrupted distance of approximately 3.7 miles. This entire distance would be designed as a waterfront promenade. In addition, all east-west streets between Houston and West 26th Streets could potentially provide pedestrian access directly to the new waterfront park. And although the highway between northern Battery Park City and Canal Street would be depressed and open, Washington Street Urban Renewal Area residents would have waterfront access via a pedestrian walkway at Harrison Street.

The additional 80 acres of public open space provided by the Outboard alternative would help alleviate the present shortage in the Study Corridor. Approximately 11.6 of these acres would be along the waterfront in Lower Manhattan, increasing its public open space ratio to about 1.29 acres per thousand residents under the minimum growth forecast. Greenwich Village would receive a total of 43.6 acres, six times the present amount. Most of this land would be along the waterfront and in an 11-acre site located at the terminus of Christopher Street. This land would raise the District Two public open space ratio to approximately 1.42 acres per thousand residents, about the same as the Manhattan average. New park land in Community Planning District Four would add 20.67 acres of open space, primarily of benefit to residents of Chelsea. The new District Four public open space ratio of 0.66 would be a significant improvement over the status quo, and would be slightly higher than the suggested minimum standard.

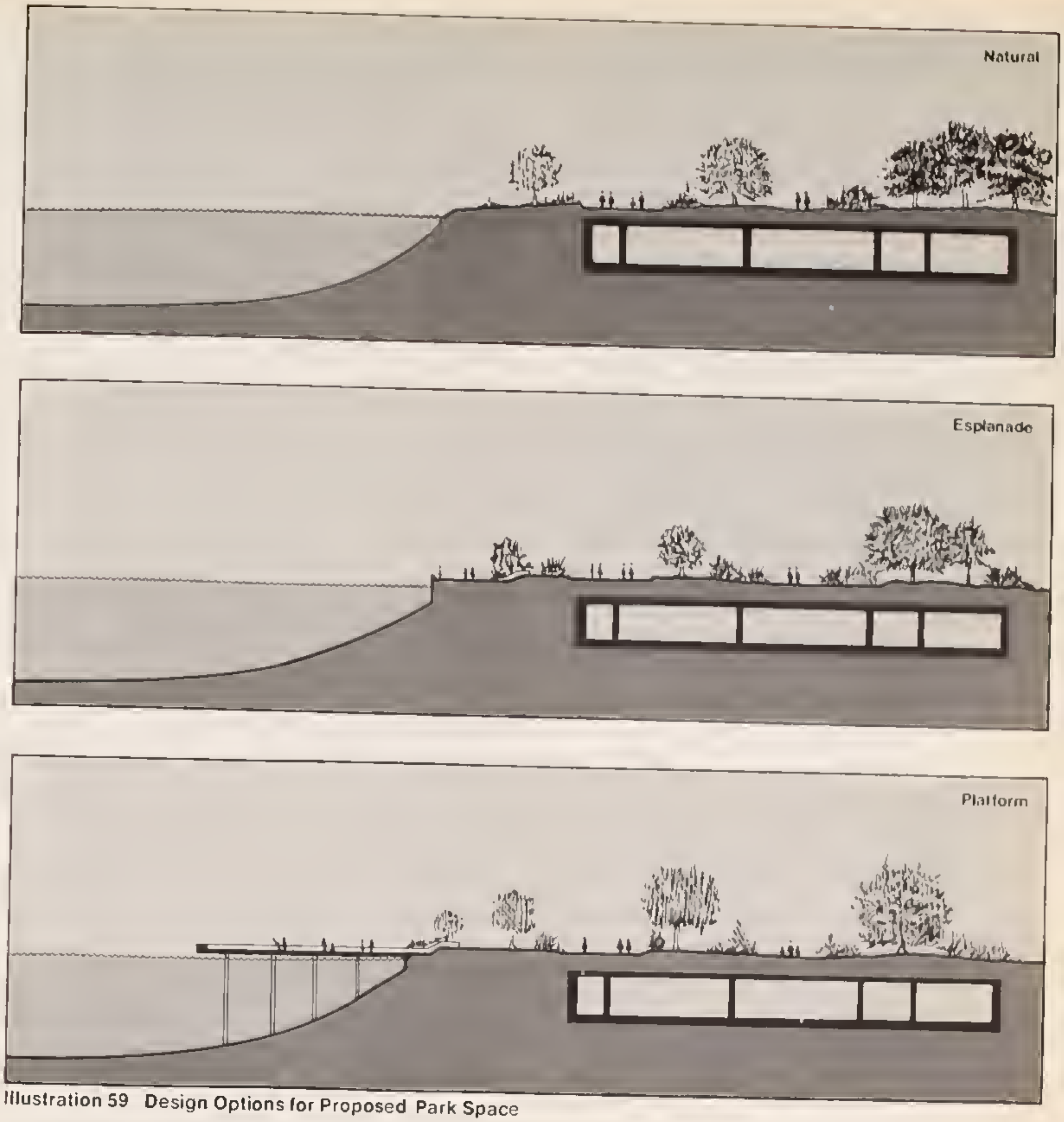


Illustration 59 Design Options for Proposed Park Space

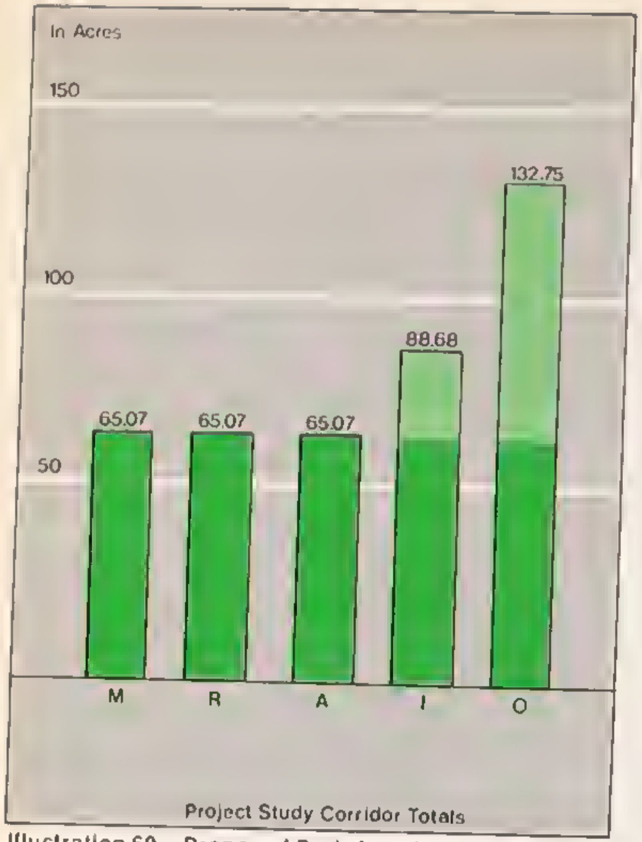


Illustration 60 Proposed Park Area for the Study Corridor (a)

(a) M: Maintenance Alternative
R: Reconstruction Alternative
A: Arterial Alternative
I: Inboard Alternative
O: Outboard Alternative

Special Considerations

Project planning and design development created several opportunities for special treatment of open space created by the Inboard and Outboard alternatives. The planning and detailed design of park and recreational facilities would be undertaken after the selection of one of the alternatives. The final design would be accomplished in consultation with the New York City Parks, Recreation and Cultural Affairs Administration and the local communities.

Special opportunities which are created as a function of the highway-transitway location and design and which can be carried out as a part of the project include pedestrian walkways, bicycle paths, landscaping and groundcover options. Additionally, opportunities may occur for alternative river-edge design options. Pedestrian paths would be an intimate part of park design, and could be built within the highway and transitway property.

The increasing ownership and use of the bicycle for recreation has led the Project to study several concepts for locating bikeway routes in the open space created by the Inboard and Outboard alternatives. The Inboard alternative would provide the opportunity to establish a bikeway, separated from vehicular traffic, approximately one mile long. The Outboard alternative would create the possibility of a bikeway traversing the entire West Side waterfront from 42nd Street near the Circle Line pier to Battery Park City in Lower Manhattan.

Alternative design treatments of the river-edge offer the opportunity for several variations in physical form. The treatments are designated as "natural edge," "platform" and "esplanade," and could be arranged to define either an active recreational area or a passive open space.

The natural edge would rely on appropriate plant materials placed in the landfill section, together with a combination of rock and earth, to provide a natural landscape treatment for passive activities such as sitting or looking at the River. Active recreational pursuits could be undertaken at the river-edge through the use of platforms and partial bulkheads. These concepts are depicted in the accompanying illustration. The designs are based on several different construction techniques, and any one or combination of these three designs may be used along the West Side waterfront.

With both the Inboard and Outboard alternatives the location of planting and landscaping would be dependent upon completion of a detailed design and planting analysis. There are restrictions associated with planting over the highway due to ground-water conditions and weight limitations. These restrictions and the types of trees, bushes and other cover which could be used are shown here. Near the edge of the water, conditions would permit only planting compatible with water suitable for secondary contact recreation. The trees and plants listed are suitable under such conditions. In the area immediately over the highway, landscaping and a pedestrian esplanade could be provided. The highway structure could support four feet of earth cover together with shrubs and grass. Special drainage would have to be provided in planting areas over the highway. Between the new facility and the bulkhead, there would be no physical limitations on the types of trees and plants that could be planted.

Summary

The five alternatives under study would have widely differing effects on the amount of public park lands and waterfront access in the Study Corridor. The Maintenance, Reconstruction and Arterial alternatives would be built generally within the right-of-way of the existing West Side Highway and West Street. By themselves, they would create no new open space and would not alter the physical configuration of the waterfront. Consequently, as the West Side population continues to grow, the recreational needs of its residents would have to be satisfied in other parts of the City. Any large-scale public action to create new parks or clean-up the waterfront would have to be funded by the City of New York.

The Inboard and Outboard alternatives would physically change the West Side by tearing down the existing West Side Highway, clearing all or part of the waterfront, and creating new public park lands next to the Hudson River.

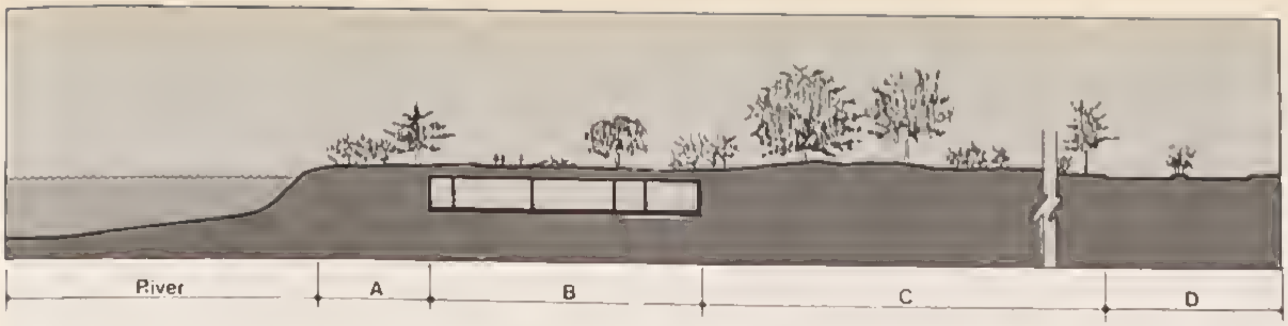


Illustration 61 Landscaping Options for Proposed Park Space

	Common Name	Mature Height	Type	Location
Trees				
Sophora japonica	Japanese Pagoda	40′	Deciduous	A,C,D
Platanus acerifolia	London Plane	70′	Deciduous	C,D
Gingko biloba	Maidenhair	50′	Deciduous	B,C,D
Tilia tomentosa	Silver Linden	50′	Deciduous	A,B,C,D
Acer pseudoplatanus	Sycamore Maple	80′	Deciduous	B,C,D
Gleditsia triacanthos	Thornless Honey-Locust	60′	Deciduous	C,D
Quercus phellos	Willow Oak	50′	Deciduous	A,B,C,D
Minor Trees				
Malus varieties	Crab Apple	25′	Deciduous	A,B,C
Amelanchier laevis	Downy Serviceberry	20′	Deciduous	A,B,C
Pinus strobus	Eastern White Pine	60′	Evergreen	A,B,C
Pinus thunbergi	Japanese Black Pine	25′	Evergreen	A,B,C
Salix pentandra	Laurel Willow	20′	Deciduous	A
Magnolia soulangeana	Saucer Magnolia	25′	Deciduous	B,C
Crataegus phaenopyrum	Washington Hawthorne	20′	Deciduous	A,B,C,D
Shrubs				
Ilex glabra	Ink Berry	5-6′	Evergreen	A,C
Rosa wichuraiana	Memorial Rose	1′	Half Evergreen	A,B
Myrica caroliniensis	Northern Bayberry	4-5′	Evergreen	A,C
Rosa rugosa	Red Rugosa Rose	4-6′	Deciduous	A,C
Rosa nitida	Shining Rose	3-4′	Deciduous	A,C
Ground Cover				
Tripterygium regelia	Chinese Matrimony Vine	—	Perennial	A,B
Juniperus horizontalis	Creeping Juniper	—	Evergreen	A,B,C
Coronilla varia	Crown Vetch	—	Perennial	B
Hedera helix	English Ivy	—	Evergreen	B

The existing West Side Highway is visually and physically disorienting for both drivers and pedestrians in Lower Manhattan

Impacts on the Visual Environment

Aesthetic considerations are determined by an individual's perception of his physical environment and the value which he places upon it. The Project alternatives offer a choice among no change, modest change and extensive change of the Hudson River waterfront. Among their most dramatic differences are visual and aesthetic effects.

Manhattan is an island, and its greatest natural resource is its waterfront. Allowing people to see, use and enjoy the waterfront is a major potential amenity for Manhattan which is only partially realized today.

On the West Side below 60th Street, less than ten percent of the waterfront is open space accessible to the public. Most of the waterfront is visually blocked from adjacent areas by pier headhouses and the existing elevated Highway. As a result, communities within the West Side Study Corridor have little perception of Manhattan as an island, or appreciation of the Hudson River an an amenity and a welcome contrast to the dense man-made upland environment. Rather, the elevated Highway and deteriorated piers are the dominant elements of the waterfront.

The Steering Committee reflected an awareness of the importance of the visual environment in one of its Policy Statements:

- **Assure aesthetic compatibility between the reconstructed facility and adjacent areas along the waterfront.**

The importance of the viusal environment is in its stimulative effects upon individuals, and their responses to it. What individuals see provides information and orientation, and stimulates subjective responses that define the qualitative image of their community.

In addition to the effect which each alternative would have on the relationship between Manhattan and its waterfront, there are other smaller scale aesthetic differences among the alternatives. In order to delineate these differences, it is necessary to discuss the alternatives from several different vantage points. Each alternative has different implications when examined in terms of those who live or work in the immediate vicinity, as compared with those who would use the transportation facility. Also, the alternatives can be differentiated in terms of the potential opportunities for future aesthetic choices.

Maintenance

The Maintenance alternative entails no important structural or design changes to the existing Highway. Its aesthetic effect would be no different than the present.

This alternative would have a significant negative aesthetic impact in Lower Manhattan in relation to new development, both planned and presently under construction. The visual requirements of the Lower Manhattan Plan, and the officially approved plans for Battery Park City, the Washington Street Urban Renewal Area and the Greenwich Special Zoning District mandate the construction of a system of elevated pedestrian bridges over West Street intended to unify, both visually and physically, offshore and upland development. The existing elevated Highway would preclude completion of this system. It also would interrupt the visual continuity of pedestrian movement to and from the planned residential community of Battery Park City, including its parks, restaurants and mile-long waterfront esplanade. Either the pedestrian bridges would have to be lifted to a height of 50 feet above West Street to span the Highway, blocking views to the water, or pedestrians would have to cross under the Highway on West Street, where vehicular travel would be heavy and congested.

The existing Highway and pier headhouses would continue to be a visual and psychological barrier between the waterfront and the residential sections of the West Village and Chelsea. This barrier effect is the result of a combination of the heavy appearance of the roadway itself, the often random placement of supporting columns, having little or no relationship to the geometry of the adjacent street system, the deep shadows cast beneath the roadway, and the massive continuous parapet which is in conflict with the small scale and variegated character of most adjacent buildings. Because of this barrier effect, views of the Hudson River are blocked from streets approaching the River. Maintenance would continue to reinforce perception of the riverfront as a place adjacent to but not an integral part of these communites.

The driver would have the changing panorama of the New York City skyline visible above the parapet walls. However, as he proceeds along the Highway, his sense of continuity and ability to see the skyline would remain circumscribed by the sharp bends, inadequate geometry and limited sight lines.

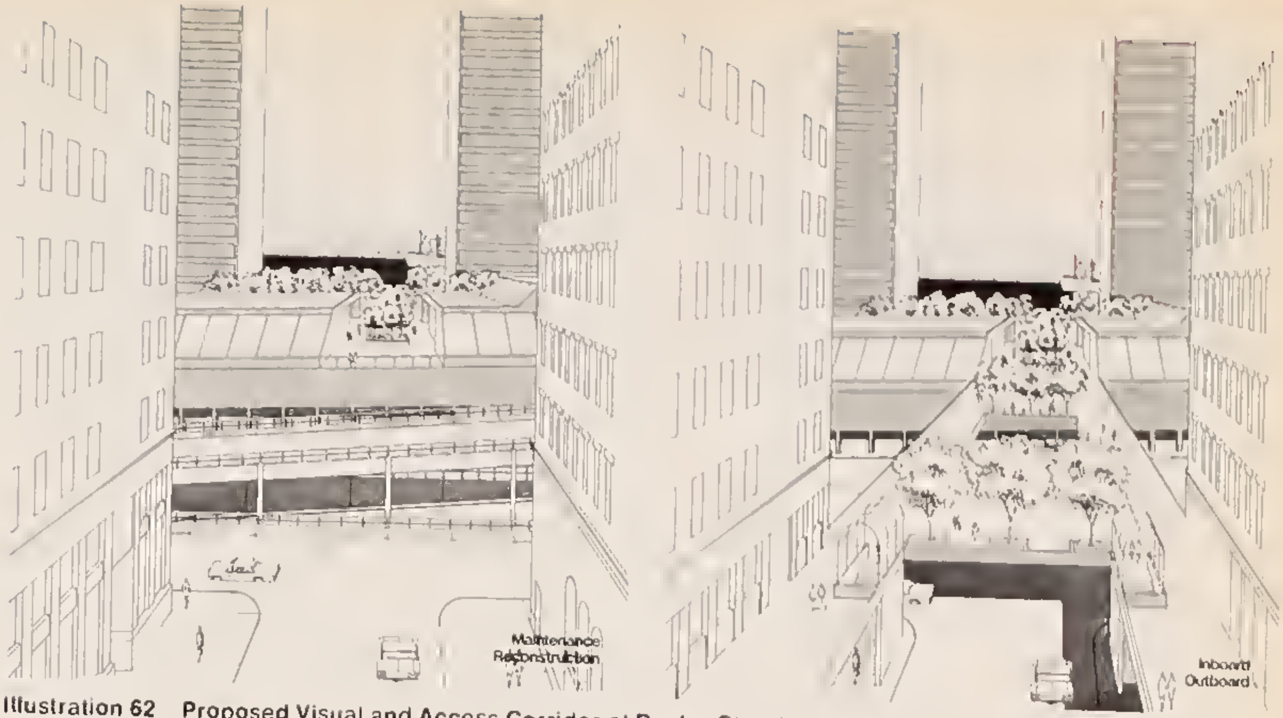


Illustration 62 Proposed Visual and Access Corridor at Rector Street

Reconstruction

The Reconstruction alternative, like the Maintenance alternative, would continue to serve as a psychological and physical barrier to the waterfront for people in upland areas east of the highway. This separation would in part be heightened by additional ramps at 23rd and 57th Streets. Because most existing ramps would be relocated to the outer edges of the highway, the viewer from the upland streets would be confronted, in addition to the highway, with the strong diagonal of the ramp across the opening at the end of the street.

This alternative would re-use the foundations and columns of the existing structure wherever possible. Although there is the possibility of an elevated highway along an urban waterfront being a gateway rather than a barrier, this would not be brought about by remodeling the West Side Highway. The column system for the existing Highway was designed for economical spans, and has little relationship to the east-west streets which abut the present structure.

For drivers, the elevation above West Street and lack of obstruction in places would enable them to view the skyline of Manhattan to the east. To the west, there are several stretches of road unblocked by piers, where the driver would have unencumbered views of the Hudson River and the New Jersey Palisades beyond.

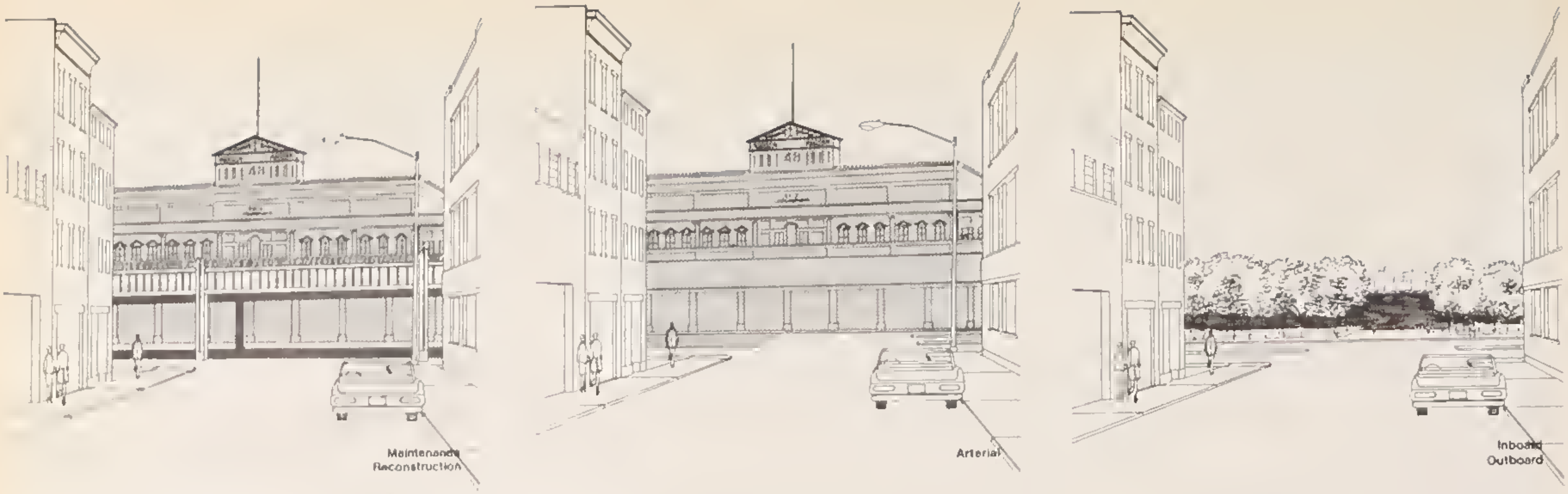


Illustration 63 Proposed Visual and Access Corridor at West 11th Street

Arterial
The Arterial alternative would remove the visual barrier of an elevated highway, but would replace it with a physical barrier to the waterfront of considerable magnitude. This would be the result of a typical six lanes of traffic, plus intermittent service roads at grade within a right-of-way 250 feet wide. Because of the signalization system necessary to efficiently handle large volumes of traffic, the relatively great distances of these signals from one another, and the actual physical dimensions of the Arterial, pedestrian access from upland areas to the waterfront would be difficult. It would not be possible for most pedestrians to traverse the 250 feet within the time span of one green light. With a planned green time at each signal of only 24 seconds in the east-west direction, and 96 seconds in the north-south direction, pedestrians would first have to move to the median of the Arterial, wait approximately a minute and a half for the next light change, and then cross to the other side of the street. Signals stopping traffic in both north and south directions simultaneously would be provided at Canal, Christopher, 14th, 23rd and 34th Streets.

The Arterial alternative would offer drivers a more limited opportunity to view the City skyline from the edge of the Island. Drivers would be at the level of West Street, and their view of the skyline would be blocked occasionally, depending on the heights of the buildings along West Street. There would be a more immediate view of the waterfront and a sense of being in closer contact with it. However, the geometry of the street itself would detract from the sense of continuity. The emergence and disappearance of service roads paralleling the facility, the occasional truck parking areas, and the alternating widths of walls along West Street would interrupt the rhythm along the roadway.

Inboard
The Inboard alternative would have significantly different effects on the visual environment, because of its design in each of the community areas. In Lower Manhattan , the highway and transitway would be depressed below the grade of West Street, and partially covered and ventilated This would allow the implementation of the planned elevated pedestrian circulation system intended to connect Battery Park City physically and visually with the rest of Lower Manhattan. However, the highway and transitway would extend as much as 140 feet into the Battery Park City project. Unless the Battery Park City Authority would develop the air-rights over the new highway, the new off-shore community would be separated physically and visually from the rest of Lower Manhattan by about 380 feet. This distance would result in a visual and psychological separation.

Opposite the Washington Street Urban Renewal Area, the highway, transitway and ramps of the Holland Tunnel interchange would occupy a considerable area. From the northwest corner of the proposed Manhattan Community College west over the new highway to the outer edges of West Street would be a distance of about 520 feet. Because the highway component would be located in an open depressed cut, pedestrian bridges have been planned for the area between Harrison and King Streets.

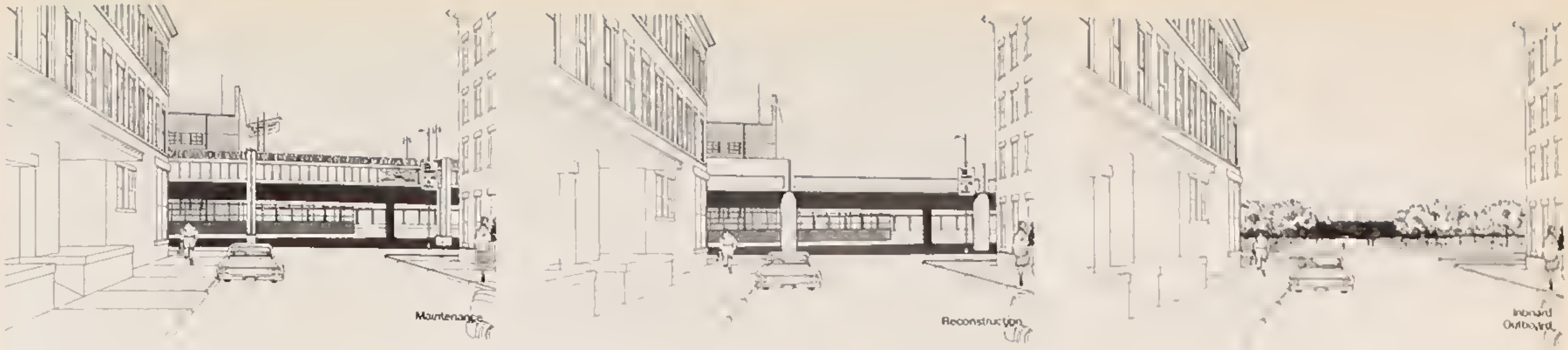


Illustration 64 **Proposed Visual and Access Corridor at West 22nd Street**

From Pier 40 north to the Marine Transfer Station, the highway would be depressed and covered. The six piers between Christopher Street and the Gansevoort Destructor would be removed, thus opening to the water the entire length of Greenwich Village—from Houston Street to Gansevoort Street. Starting at Gansevoort Street and extending north to 16th Street, the highway would rise from a depressed section to an elevated one, with West Street divided on either side of the highway. The width of the right-of-way through the interchange, because of the exit ramps and the lanes of West Street, would be about 480 feet. North of 16th Street, because the highway would be elevated, the visual effect would be similar to that for the Maintenance and Reconstruction alternatives.

Tunnel Connections There are two ramp connection options at the Holland Tunnel. One, a "two-corridor" connection, would run from the new highway eastward along North Moore Street and Canal Street. The southern leg of this interchange would pass through the northernmost parcel of the Washington Street Urban Renewal area. The ramps would impact the proposed housing site by cutting the parcel into two smaller sites. The smaller of the two resulting parcels on the northern side of the ramp would be rendered less attractive for housing because of its narrow triangular shape. The northern leg of the interchange is simpler, and would be less disruptive because it is compatible with the existing grid, and would pass by industrial land uses which are relatively insensitive to the presence of such ramps. The cumulative effect of the two-corridor interchange would be to surround this 20 square block area of industrial land use.

The other interchange is a "one-corridor" connection to the Holland Tunnel, located entirely within the Canal Street area, amid essentially industrial uses. It would have no disruptive effect on the northern housing parcel of the Washington Street Urban Renewal Area, six blocks to the south. The geometry of the ramps themselves, however, would not conform to the street pattern of Canal Street, but would be more free form, spreading over a larger area and detracting from the sense of the street.

There are also two alternative interchanges at the Lincoln Tunnel. One is located between 30th and 31st Streets, the other between 35th and 36th Streets. Either would pass through an area essentially industrial in character. The differences between the two rest in the potential impact on the overall configuration of the railroad yards. The 30th-31st Street corridor would leave most of the yards intact, and the 35th-36th Street corridor would cut the yards in half.

Ventilation Buildings The proposed buildings which would house mechanical ventilation equipment, because of their various locations, have been planned to respond to a number of different design criteria. The vent building opposite the Brooklyn-Battery Tunnel entrance, because of its isolation in an open area on the West Street median, would be treated as a sculptural element marking the entrances to the Tunnel and to the Battery Park Underpass. The ventilation building at Harrison Street, to the west of the highway, would be located so as not to block views of the water from upland streets. The south face of the building has been aligned with the other buildings along Harrison street. The ventilation building opposite Pier 40 would be located between Clarkson and Leroy Streets. It has been designed without setbacks and situated so as to maintain the continuity of the building frontages in the street. Its height is in scale with other buildings in the neighborhood. The ventilation building at the other end of the covered section, at Gansevoort Street, has been treated in a slightly different fashion. The building would sit at the end of the new park created over the covered highway in front of the West Village. It has been designed to present a low profile, in order to maintain the scale of the new park.

West Street Varied design treatments of West Street have been incorporated along the length of the Study Corridor. In the Battery Park City area, around the Holland Tunnel interchange and at the Gansevoort-14th Street Meat Market area, the service roads would be located on either side of the mainline of the highway. This would result in a wide right-of-way between the upland and the waterfront, and would give the new West Street a different character from other streets in Manhattan. In the Greenwich Village area, the new West Street would pass through an open park built over the main highway, with buildings on the east side of the street only. The street is perceived as part of the park land. Visually, the park land begins at the building line on the east side of the street. In the final design stage, a coordinated landscape design could treat the sidewalk, the median between the street lanes and the park land as a whole. The entire area could be designed with a similar character, since the design of the covered section allows for four feet of earth on the roof to allow for the planting of full size trees wherever appropriate.

North of 16th Street, West Street would be located beneath the elevated highway, with buildings on both sides. Visually it would be similar to the existing highway and West Street. For motorists on the highway, the visual experience would be significantly different in each area.

In the Battery Park City area, the Inboard alternative would offer different experiences for northbound and southbound drivers. The northbound lanes are depressed and open, while the southbound lanes are depressed and covered. Northbound drivers emerging from the Brooklyn-Battery Tunnel would be able to see both the skyline of Lower Manhattan to the right, and Battery Park City to the left. The view at the Holland Tunnel Interchange area would be relatively unencumbered except for the overhead ramps to the tunnel. From Pier 40 to Gansevoort Street, the highway would be in a covered section, interrupting the driver's view. From Gansevoort Street until it connects with the existing West Side Highway at 42nd Street, the driver's view and sense of the City from the highway would be similar to that experienced in both the Maintenance and Reconstruction alternatives. Special note should be made of the ramps leading to and from the highway into both the Holland and Lincoln Tunnels. For drivers, in an eastbound direction, there would be dramatic views of the City until the ramps descend into the existing tunnel approach roads. Similarly, drivers entering Manhattan from the tunnels and proceeding onto the highway would have dramatic views of the Hudson River.

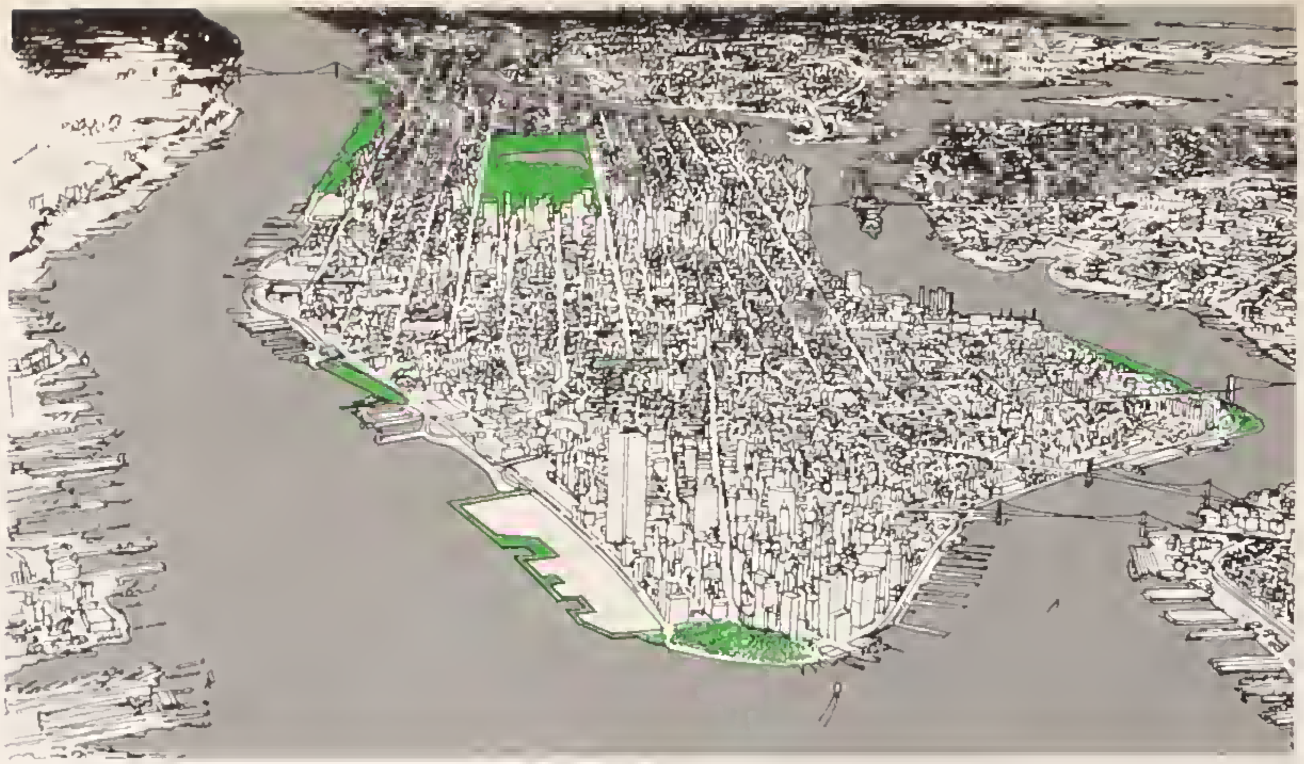


Illustration 65 Inboard Alternative Waterfront Configuration

Outboard

The Outboard alternative would create an entirely new visual environment for the Hudson River waterfront. This alternative, which strongly influences changes from industrial to residential land use, would create a visual amenity as an integral part of neighborhoods adjacent to it. It would create the opportunity for residents to have a direct view of the River from their streets, and to walk directly to and along the water's edge in a landscaped park setting.

The Outboard proposes that construction of a new highway and transitway should be used to achieve a new visual environment of the Hudson River waterfront, consistent with the innovative design that created Riverside Park, Carl Shurz Park, the United Nations Plaza, Battery Park and the public waterfront parks and esplanades planned to encircle Lower Manhattan, now under construction.

The new waterfront park would visually be an integral part of the West Side residential communities, rather than a place apart, by removing the existing barriers to the waterfront. The linear quality of the park would lend itself to bikeways, esplanades, pathways and recreation activities extending more than three miles along the waterfront.

The design and aesthetic impact of this alternative in Lower Manhattan would be virtually the same as the Inboard alternative, with one significant exception. The highway and transitway would intrude into Battery Park City to a lesser extent than the Inboard alternative, requiring no more than 80 feet between Liberty and Vesey Streets, and 30 to 40 feet elsewhere. The Battery Park City Authority could develop the air-rights over the depressed highway and transitway much more easily and economically than with the Inboard alternative.

From Canal Street north to 27th Street, opposite the West Village and Chelsea communities, the highway and transitway would be depressed and completely covered, eliminating all piers and continuing the landscaped waterfront park to 27th Street, connecting to a 50-foot wide esplanade extending north along the water to the Circle Line piers near 42nd Street. Thus, all of the streets approaching the River, from Canal to 27th Street in the West Village and Chelsea, would have the potential to be visually opened to the water, providing an uninterrupted view of the Hudson River from upland streets. These visual corridors to the water from the streets of the West Village and Chelsea are an essential element of this alternative.

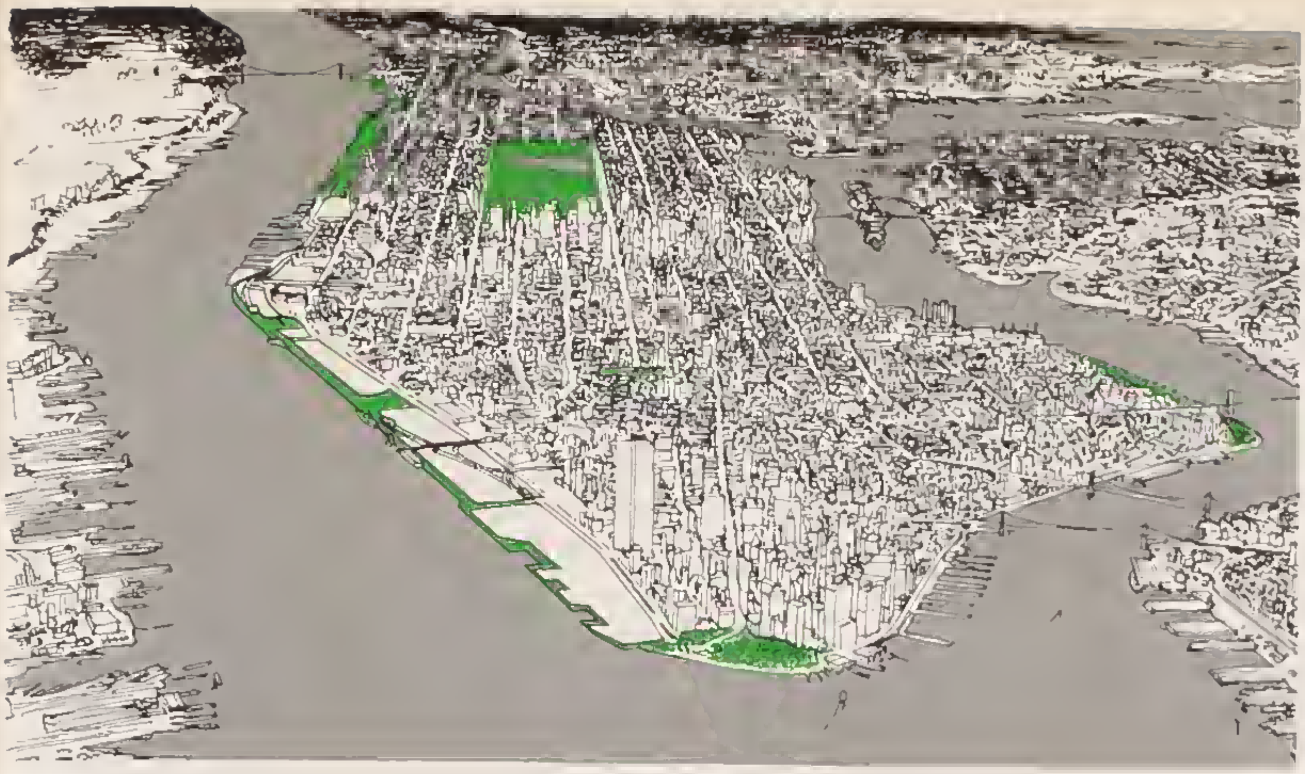


Illustration 66 Outboard Alternative Waterfront Configuration

Tunnel Connections The alternative interchanges at the Holland and Lincoln Tunnels are similar in intent and configuration to those described for the Inboard alternative, and the effect of their design and location would be essentially the same.

Ventilation Buildings With the exception of the ventilation buildings at 14th Street, all the structures are similar in intent to the Inboard alternative. At 14th Street, the ventilation buildings would serve a different function. Here, they have been arranged on both sides of the entrance and exit ramps from the highway with a bridge over 14th Street, so as not to interrupt the park which would continue on either side. Park users could walk up and over the bridge without leaving the Park. In final design, the buildings could be scaled to the park, or they could be integrated into the park with earth berming. The bridge solution would add a new dimension to the park, in that it would give height in what is otherwise a flat esplanade, and produce an effect similar to the grade changes in Carl Shurz Park over the FDR Drive. There, the park rises 35 feet above the water, allowing the user to move in a short distance from a vantage point overlooking the East River to close contact with the River itself. The topography of the West Side for the most part is flat and low lying, and affords few natural opportunities for such changes in elevation.

West Street The design of West Street in the Outboard alternative is relatively clean and simple, and more consistent with typical Manhattan avenues than the Inboard. However, adjacent to the numerous West Village warehouses and the Gansevoort-14th Street Meat Market, the street has been aligned to provide a buffer strip in order to retain truck parking and loading facilities as long as they have an economic use in the area. In the long term, the buffer strip, which would widen West Street through the West Village, would provide a continuity of open space along all of the building fronts on West Street. North of 14th Street, West Street would again be brought closer to the existing buildings, and its effect much less apparent, although it would still be wider than nearby north-south streets.

From Battery Park City to the Holland Tunnel interchange, the driver's experience would be essentially the same as that for the Inboard alternative. At about Houston Street, the highway drops into a covered section. Unlike the Inboard alternative, the highway stays covered until just north of 27th Street, at which point it rises to connect to the existing West Side Highway. The driver's experience in the Holland Tunnel and Lincoln Tunnel interchanges would be similar to the Inboard alternative. In both instances, there would be similar dramatic views of New York City. Views of the waterfront, however, would be limited by interchange ramps and, at the Holland Tunnel, would be further limited by the distance of the roadway from the water.

Changes in Travel and Traffic Patterns

The five Project alternatives differ significantly in their potential effects on travel and traffic patterns in Manhattan. This discussion identifies and assesses the magnitudes of those differences. At the outset of the Project, the Steering Committee noted the inadequacies of the existing West Side Highway, and the opportunities that its reconstruction or replacement would provide to improve transportation in the Study Corridor, and to reduce the costs of goods movement in Manhattan. The Steering Committee specified that one Project goal was to:

- **Improve the efficiency and quality of moving people and goods to and from Manhattan, especially within the West Side Corridor.**

In addition, the Steering Committee adopted the following Policy Statements for Project studies relating to travel and traffic patterns:

- **Develop parking strategies consistent with the needs of each corridor plan and designed in concert with mass transportation schemes to provide for reduction of parking demand in business districts.**
- **Encourage travel of trucks and buses along the periphery of Manhattan, i.e., on the West Side Highway, and away from the local street system; consider the application of preferential treatment traffic controls.**
- **Investigate the application of regulatory and perhaps economic controls, as well as operational traffic controls in the achievement of desirable traffic flow characteristics throughout the roadway transportation system.**
- **Assure that traffic conditions on the West Side street system are not adversely affected and attempt to substantially improve them. Special emphasis shall be placed upon the Lincoln, Holland and Brooklyn-Battery tunnel areas.**
- **Control and improve the quality of traffic flow on the West Side Highway over that which currently exists.**
- **Provide convenient access along the West Side for the purpose of efficiently collecting and distributing Manhattan traffic to/from the Interstate System which presently terminates at the Lincoln, Holland, and Brooklyn-Battery Tunnels.**
- **Provide for accommodation of an as yet undetermined amount of travel demand which eventually may be generated by development and/or redevelopment of land within the corridor, and which presently emanates from major generators.**
- **Discourage the attraction of additional regional travel diversions within the corridor, in excess of those currently taking place. Assume the capacity of the tunnels will not be expanded in the future, i.e., program additional capacity for the highway only to accommodate the diversion of traffic from the West Side street system and projected corridor growth.**
- **Consider, thus plan and design, the reconstructed facility to function as an integral part of the city and regional roadway transportation system.**
- **Improve the streets directly affected by reconstruction of the highway necessary to achieve consistency and balance in roadway traffic flow.**
- **Investigate the potential opportunity for utilization of mass transportation within the highway corridor, based upon its demonstrated need and utility, and upon its anticipated inherent benefits; and having determined the degree to which such public transportation services and facilities are warranted, incorporate them in the project.**

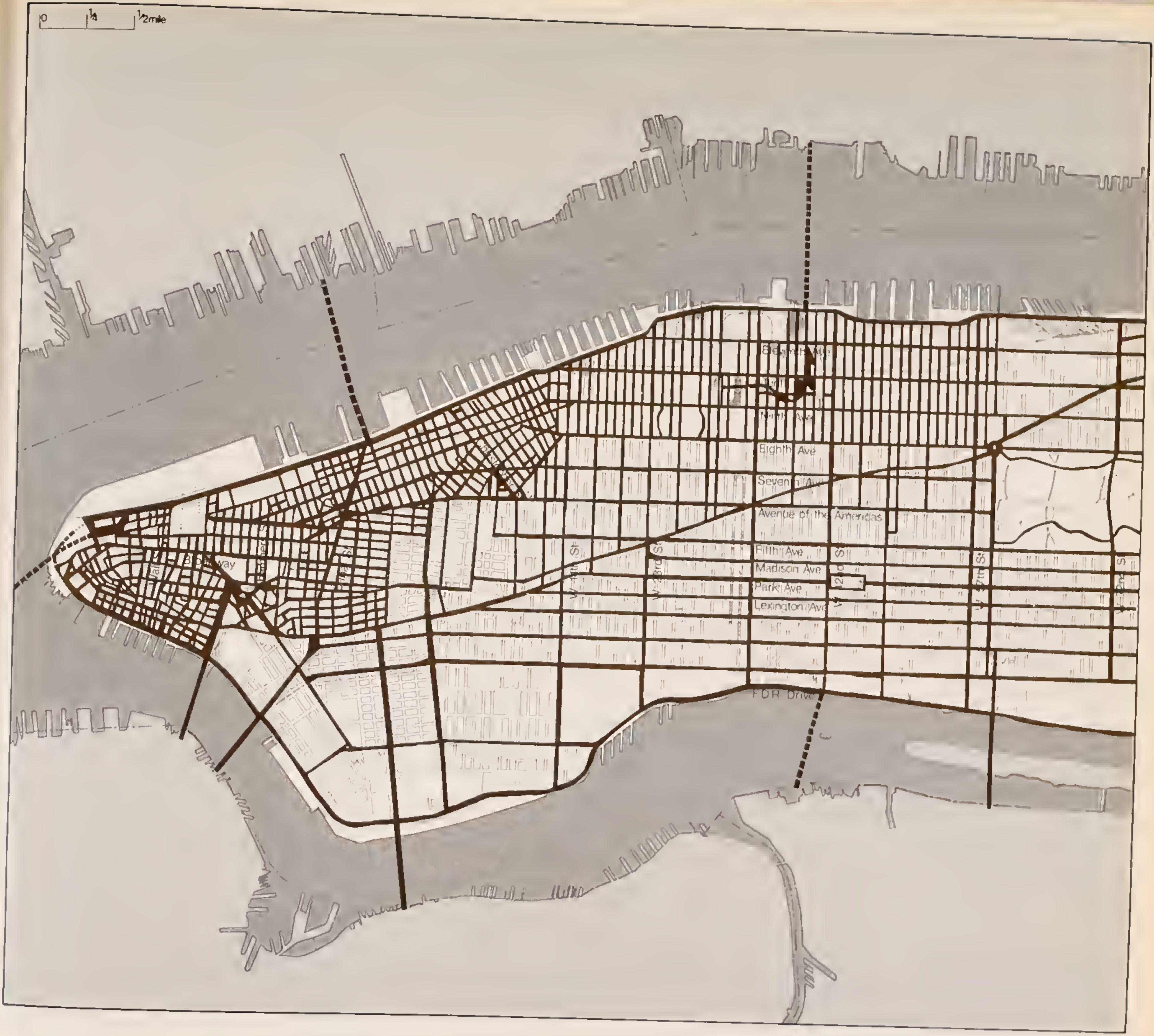
Much of the information and data presented here result from an extensive Project program of computer-based simulations and analysis. In addition, the Project made use of data and information developed by the Tri-State Regional Planning Commission, the Port Authority of New York and New Jersey, and the Regional Plan Association. All results are reported and compared, using the minimum land-use forecast, 1995. The Steering Committee, as a matter of policy, requested traffic assignments based upon a range of land-use forecasts—from minimum to moderate growth. Assignments were made for the Inboard, Outboard and Arterial alternatives, with both express bus and rail transit assumptions. The range of results are available at the Project office, but are not presented here, in order to avoid confusing comparisons of traffic forecasts using different sets of population, employment, autos available and other factors.

The traditional forecasting and traffic assignment methodology utilized by the Project is based upon the fundamental that traffic will seek and follow the shortest time path between origins and destinations of trips. The use of complex computer technology permits thousands of trips to be assigned over a complex network of highways and streets, simulating traffic patterns on the real street system, as shown in Illustration 67.

Illustration 67 Project Traffic Analysis Roadway Network South of 72nd Street

🟫 Roadway Network

↗ North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1/4
1/2 mile
Wall
Broadway
Chambers St
Canal St
Ninth Ave
Eighth Ave
Seventh Ave
Avenue of the Americas
Fifth Ave
Madison Ave
Park Ave
Lexington Ave
W 14th St
W 23rd St
W 42nd St
W 57th St
W 72nd St
FDR Drive

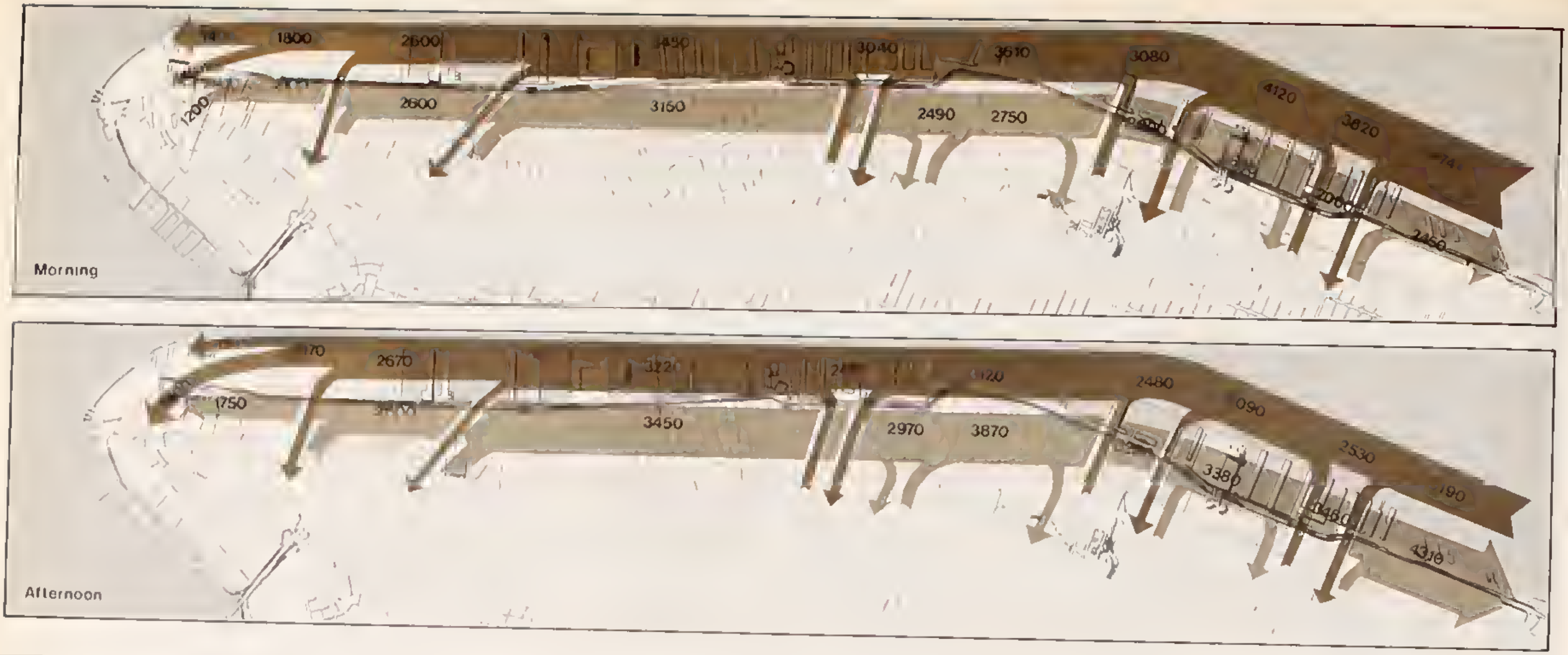


Illustration 68 Morning and Afternoon Peak Hour Traffic Volumes on West Side Highway in 1972

▨ Northbound Volume

🟫 Southbound Volume

North

The strength of this process is that it is rigorously systematic in the results it obtains, providing it always is given the same basic data and the same instructions on how to process and use the data. The comparisons of traffic discussed here result from an assignment process in which all factors, except the different alternative highway configurations and the different number of trips diverted from automobiles to the alternative transit proposals, were held constant.

The reader is cautioned that the traffic volumes reported are estimates of demand based on a minimum time path assignment, and that these demand estimates exceed the estimated capacity of the roadways in some areas of some alternatives. Volumes significantly in excess of the capacity estimates would not occur in the real world, although under some special conditions, actual volumes on roadways do exceed the theoretically estimated capacities.

Traffic volumes on the existing West Side Highway in 1972 morning and afternoon peak hours are shown in Illustration 68. These volumes resulted in spite of a number of undesirable design conditions of the Highway. Problems of physical layout included poor ramp location and design, sharp curves, inadequate width, lack of shoulders and poor pavement surface. The poor physical design, plus the absence of traffic management capability, resulted in congestion, delay and unsatisfactory peak-hour travel conditions for all users of the existing facility.

Highway Operations

Traffic Flow Quality

An important objective of the Project was to "improve the quality of traffic flow on the West Side Highway over that which currently exists." This policy recognizes the undesirable traffic flow conditions on the existing Highway related to physical layout and roadway capacity.

Good traffic flow is considered to occur when vehicles may enter a roadway safely, join the traffic stream, and move along at a reasonable speed to an exit location without encountering conditions requiring frequent stops and starts, congestion or delays, and severe interference from other vehicles.

The five alternatives may be compared with regard to flow quality, considering, first, the degree of difference that would result from physical design alone, and, second, the degree to which surveillance and control systems would need to be utilized to "influence" or "manage" traffic flow. To allow this two-stage evaluation, Project traffic estimates were prepared to reflect realistic interactions of traffic demand and travel conditions on the entire system of roadways, but without incorporating the effects of traffic management that would be possible through use of the proposed control system.

Under the Maintenance alternative, there would be no improvement in flow quality because all roadway and ramp elements would be left unchanged. No traffic management system would be provided.

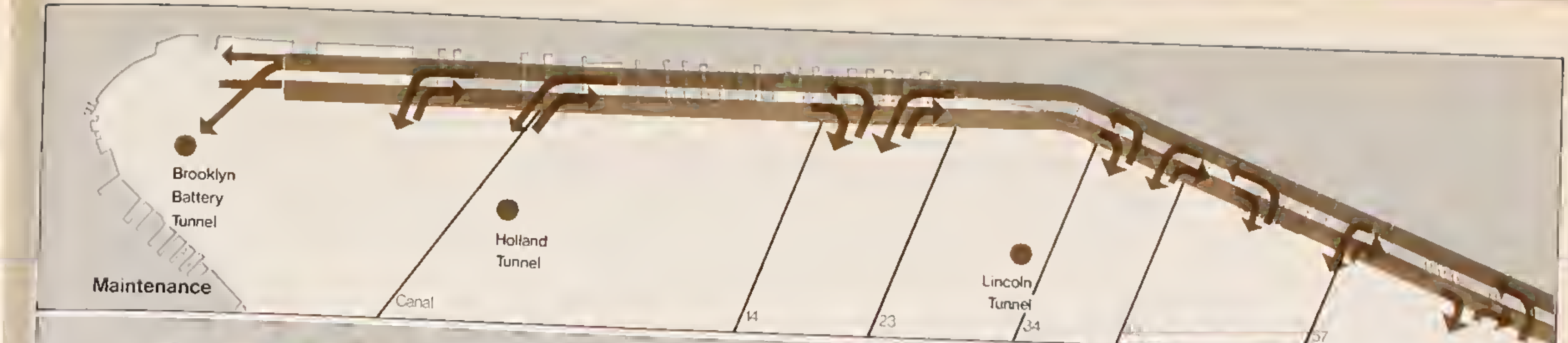
In the other four alternatives, however, the physical roadway conditions would be changed and improved in various ways to increase safety and capacity. For each, a sophisticated traffic surveillance and control system would be included to provide traffic management capability.

Illustration 69 Proposed Roadway Access for Project Alternatives

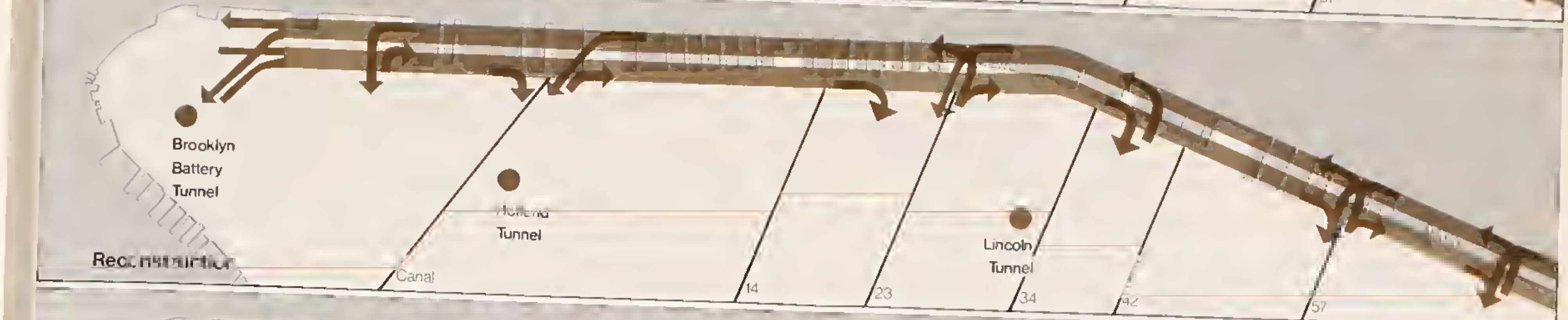
▨ West Side Highway

🟫 Access Points

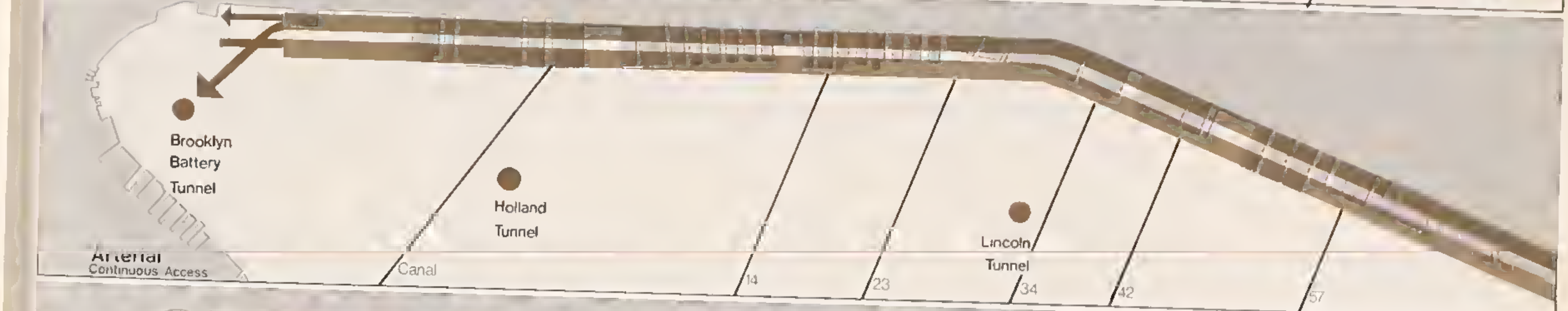
North



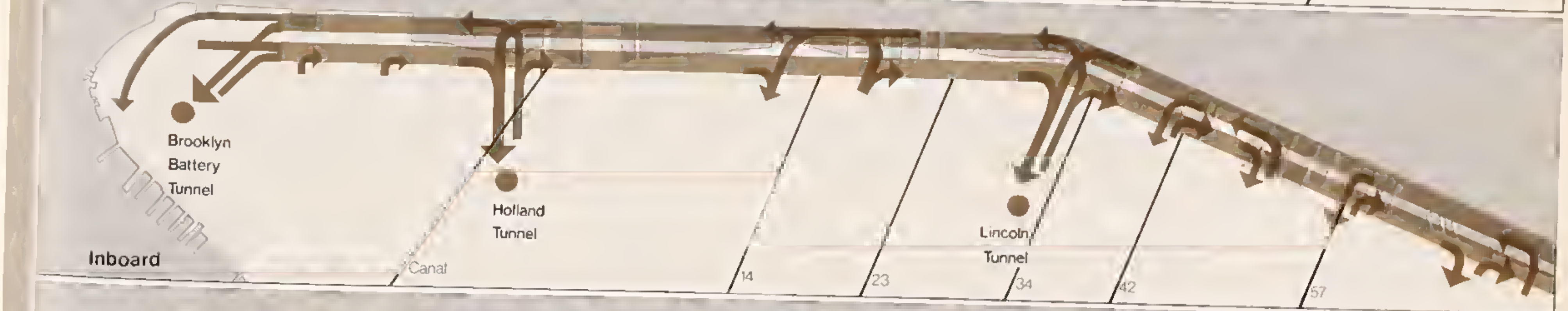
Maintenance



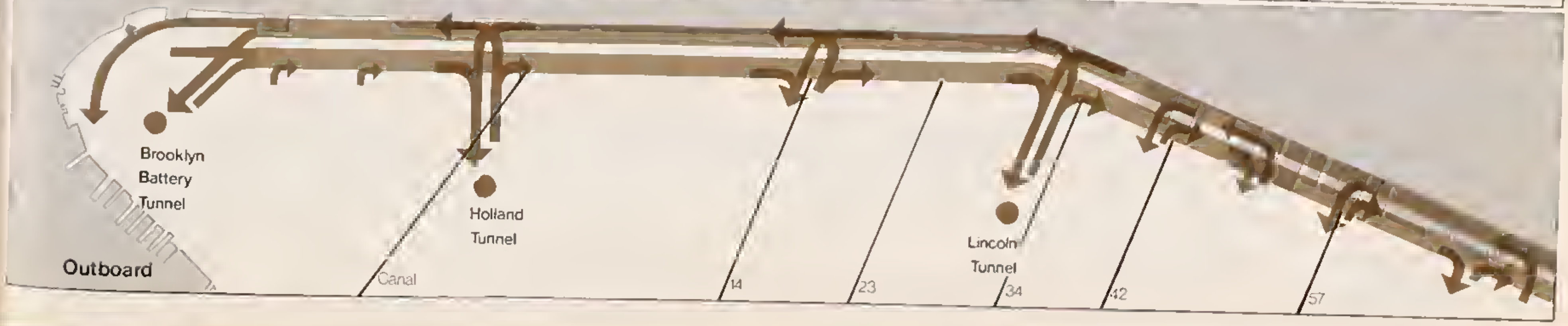
Reconstruction



Arterial
Continuous Access



Inboard



Outboard

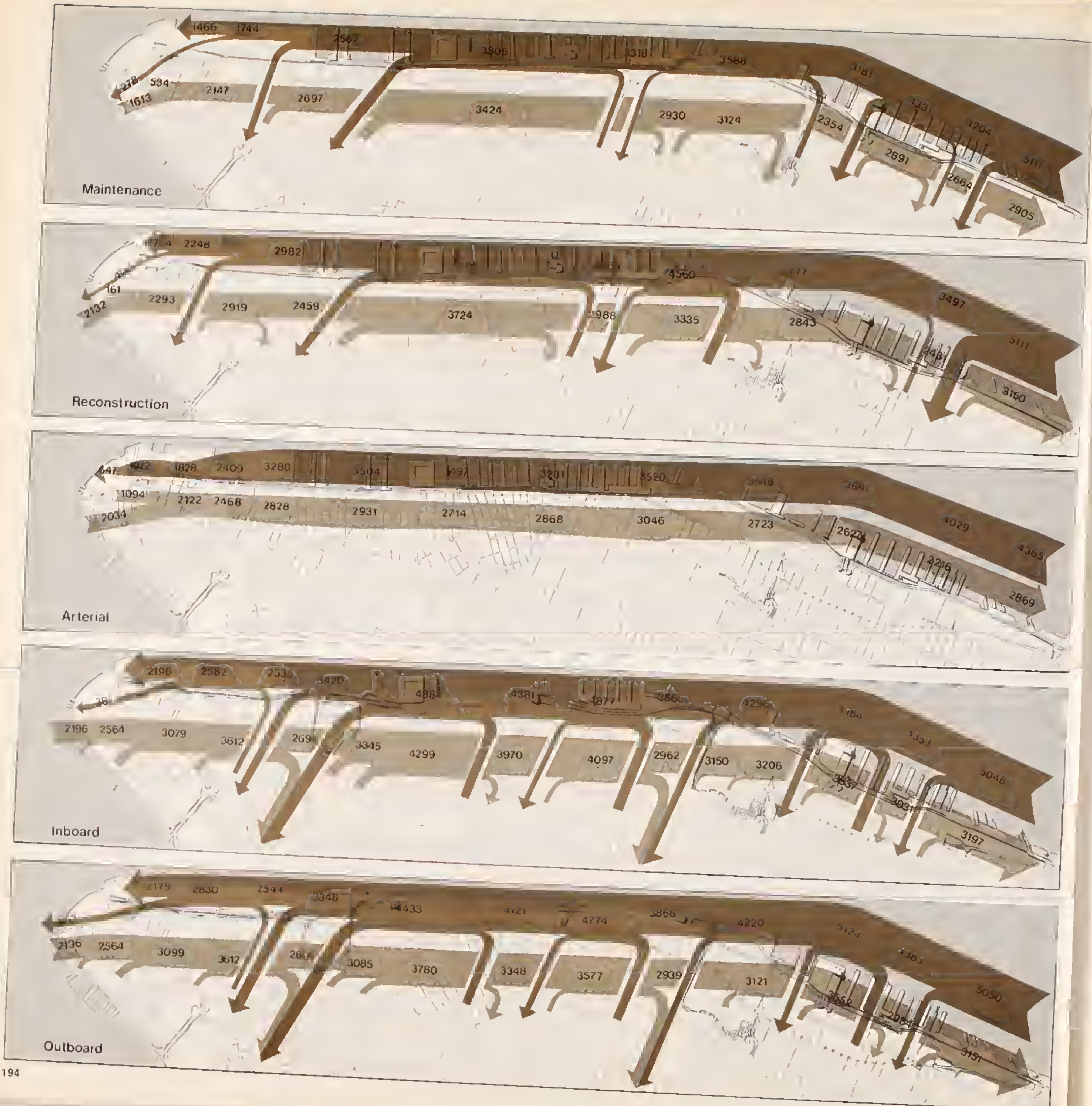

Maintenance
1744
1613
Reconstruction
Arterial
1828
2034
Inboard
Outboard

Illustration 70 Morning Peak Hour Traffic Volumes in 1995

▨ Northbound Volume

■ Southbound Volume

North

Traffic on each of the alternatives with a control system could be managed to assure adequate flow quality most of the time. The penalty for restricting access, of course, is that some drivers desiring to use the facility would be forced to wait at entrance locations, divert to other routes, or modes or to change travel habits and avoid peak-hour travel. The degree to which such forced diversion would be required to provide adequate flow quality in peak hours varies considerably among the alternatives by time of day and direction of travel, as may be seen by examining the traffic estimates and the volume to capacity ratios.

The traffic volumes estimated for the Project alternatives in the morning and afternoon peak hours are shown on Illustrations 70 and 71, respectively. The estimates as shown reflect probable traffic demand that would develop for each alternative. These estimates may be used in evaluating the relative adequacy of each alternative to provide traffic flow quality.
As discussed in the following paragraphs, the alternatives vary in their ability to provide satisfactory traffic flow conditions as measured by volume to capacity ratios (v/c) and estimated travel speed. Good traffic flow is indicated by low v/c ratios and high speed. Volume to capacity ratios below 0.9 are acceptable for urban driving conditions, while ratios over 1.0 indicate demand exceeding capacity and represent unacceptable congestion and delays, or "stop-and-go" conditions.

The comparison of alternatives is made for operating conditions during the morning and afternoon peak hours. During the remainder of the day, traffic volumes are lower and the operational differences among the alternatives becomes less significant. Tables 37 and 38 list key morning southbound and afternoon northbound speeds, and volume-capacity ratios based on the traffic volumes shown in Illustrations 70 and 71. Conditions southbound in the morning peak hour that would result without traffic management and control are indicated by the data in Table 37.

Table 37 1995 West Side Highway Travel Characteristics Southbound in the Morning Peak Hour by Segment of Highway Main Line (a)

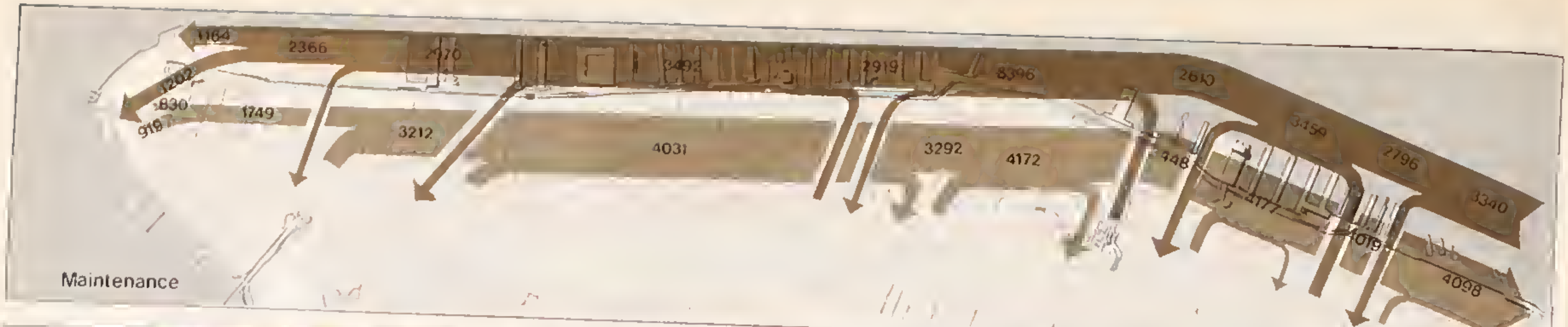
Maintenance Alternative	Speed (MPH)	V/C
North of 72nd St.	10	1.14
72nd to 59th St.	8	1.23
59th to 46th St.	13	1.04
46th to 42nd St.	10	1.14
42nd to 23rd St.	8	1.19
23rd to Canal St. (Holland Tunnel)	6	1.37
Canal to Chambers St.	19	.92
Chambers to Rector St.	32	.63
Rector to Brooklyn Battery Tunnel	29	28

Reconstruction Alternative	Speed (MPH)	V/C
North of 72nd St.	7	1.25
72nd to 59th St.	21	.94
59th to 42nd St.	18	.98
42nd to 23rd St.	8	1.19
23rd to Canal St. (Holland Tunnel)	12	1.10
Canal to Chambers St.	30	.78
Chambers to Rector St.	40	.58
Rector to Brooklyn Battery Tunnel	26	.19

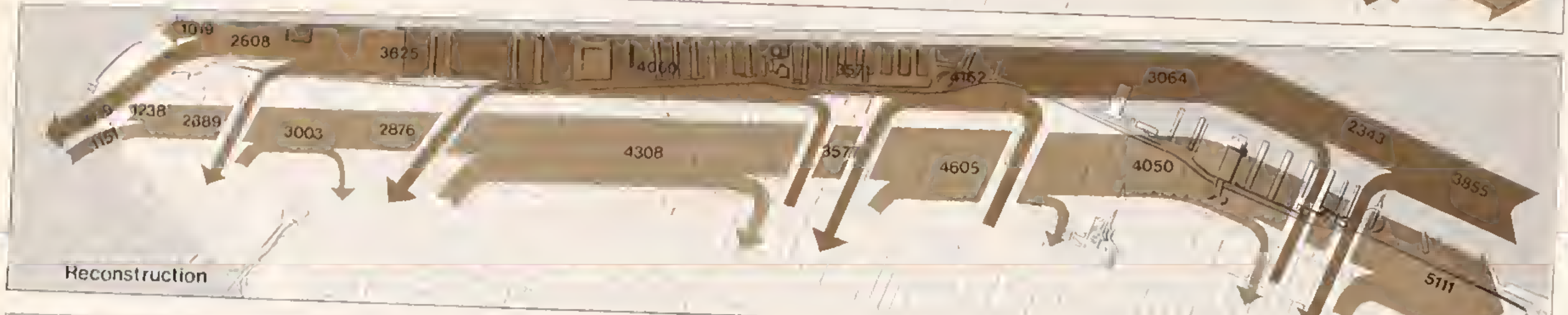
Arterial Alternative	Speed (MPH)	V/C
North of 72nd St.	16	.97
72nd to 59th St.	16	.97
59th to 55th St.	9	1.06
55th to 43rd St.	6	1.07
43rd to 38th St.	12	.96
38th to 34th St.	19	94
34th to 30th St.	19	.86
30th to 23rd St.	18	.93
23rd to 14th St.	5	1.05
14th to Christopher St.	8	1.02
Christopher to Canal St. (Holland Tunnel)	11	.95
Canal to Harrison St.	20	.89
Harrison to Rector St.	9	1.04
Rector to Brooklyn Battery Tunnel	18	.43

	Inboard Alternative		Outboard Alternative	
	Speed (MPH)	V/C	Speed (MPH)	V/C
North of 72nd St.	10	1.12	10	1.12
72nd to 55th St.	8	1.21	6	1.21
55th to 46th St.	7	1.24	6	1.23
46th St. to Lincoln Tunnel	15	1.03	14	1.01
Lincoln Tunnel to 14th St.	25	.85	32	.73
14th to Canal St. (Holland Tunnel)	24	.88	29	.80
Canal to Rector St.	43	.46	42	.51
Rector to Brooklyn Battery Tunnel	42	.50	42	.50

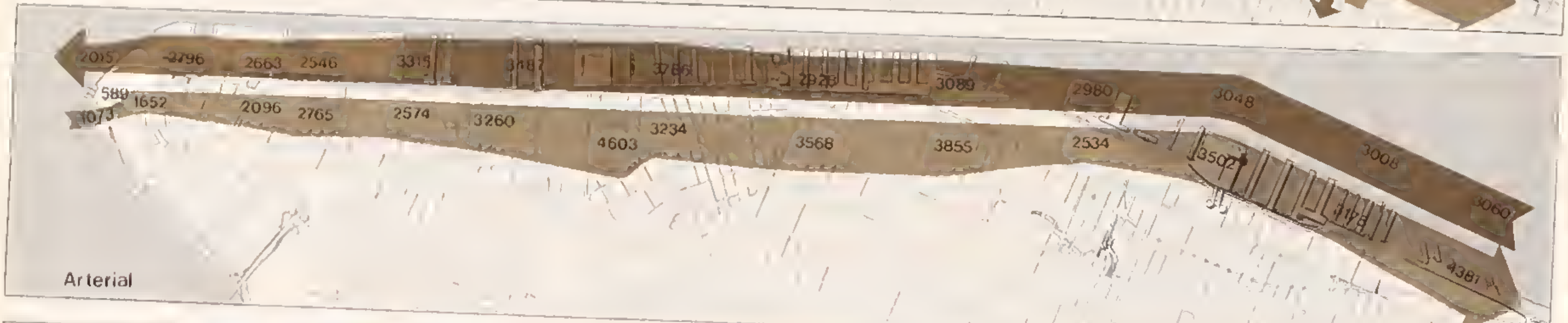
(a) See Appendix for methodology used to develop volume to capacity (v/c) ratio. Estimates are based on the Minimum (b) Land Use Forecasts and reflect traffic demand without effects of Traffic Control.



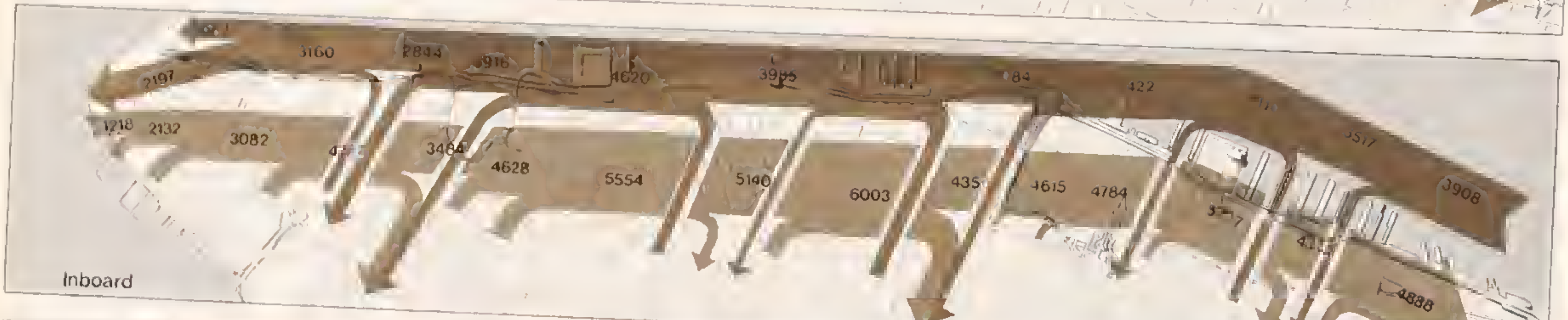
Maintenance



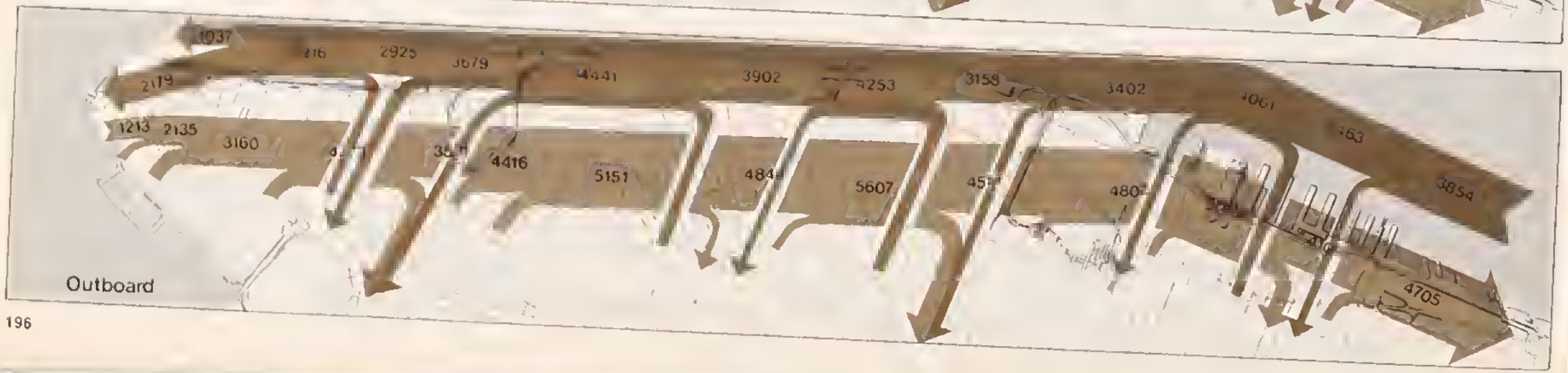
Reconstruction



Arterial



Inboard



Outboard

Illustration 71 Afternoon Peak Hour Traffic Volumes in 1995

▨ **Northbound Volume**

▨ **Southbound Volume**

North

The Maintenance alternative would result in serious congestion and delays on the southbound lanes north of Canal Street, and free flow south of Canal Street. These conditions are reflected in the speed estimates, which gradually increase from 6 mph north of Canal Street to 32 mph south of Chambers Street. The speeds indicated on Tables 37 and 38 do not reflect the influence of changes in capacity and queuing on other parts of the facility. For example, the 18 mph indicated between 59th and 42nd Streets for the Reconstruction alternative does not reflect probable traffic back-up from the section south of 42nd Street which would be overloaded. Speeds as used in this discussion are are intended to represent average conditions that could result if the estimated traffic demand should develop.

Under the Reconstruction alternative, there would be serious congestion and delays southbound on the entire roadway north of Canal Street, and free flow south of that point. Speeds between 23rd and Canal Streets would be 12 mph, and on the sections north of 23rd Street would be about 8 mph. The sections north of 42nd Street would operate at 18 to 20 mph, except for the influence of back-up from the "bottleneck" condition south of 42nd Street, which would result in speeds closer to 8 mph.

The Arterial would result in serious delay north of Canal Street, moderate delays from there to Harrison Street, and heavy congestion south to Rector Street. Total volumes on this alternative would be lower than for the others because it would operate at lower speeds and many drivers would choose alternate parallel routes for their trips. Speeds in the section from 59th Street south to 14th Street would be 5 to 6 mph, and south of that point they would increase to 9 to 10 mph. The higher speeds indicated for these roadway sections would probably not occur because queuing would build up from the lower-speed locations to the south.

The Inboard and Outboard alternatives would operate nearly identically, with severe congestion and delays north of 46th Street, moderate delays to the Lincoln Tunnel exit, then acceptable to good flow south of that point. Travel speeds would increase from 6 to 7 mph north of 46th Street, to 15 mph between the Lincoln Tunnel exit and 42nd Street, and to speeds between 24 and 42 mph in the sections south of the tunnel interchange.

In summary, the only alternatives that would operate southbound in the morning peak hour with high travel speeds, and good flow quality south of 42nd Street, without access control are the Inboard and Outboard. The Arterial would require access limitation throughout its length, and the Reconstruction alternative would require severe access limitation at the southbound entrances at 59th, 42nd and 23rd Streets to keep volumes below capacity, and to allow good flow with speeds of 20 mph or greater. Under the Maintenance alternative, without a control system, all drivers in the morning peak southbound would be subject to poor quality of flow north of Canal Street.

Southbound traffic volumes in the afternoon peak hour would be lower than in the morning peak, and the Inboard and Outboard alternatives would operate without congestion, except on the approaches to the Brooklyn-Battery Tunnel, where lack of tunnel capacity would result in queuing in the southbound lanes. The other three alternatives would experience congestion, which would be most severe on the Maintenance alternative on all sections south of 42nd Street.

The Arterial would be congested south of 30th Street, and the Reconstruction alternative would be overloaded south of 42nd Street. All alternatives would experience extensive queuing on the southbound roadway approaching the Brooklyn-Battery Tunnel resulting from lack of tunnel capacity. Extensive use of the control system would be necessary on the Arterial and Reconstruction alternatives.

Northbound volumes during the afternoon peak hour would be generally heavier than southbound volumes. Traffic on the Maintenance alternative would experience severe congestion and delay on the entire northbound roadway south of 23rd Street, caused by the sharp curves, and moderate delays north of that point to 60th Street. Relatively low speeds on this alternative resulted in volume estimates lower than for the Reconstruction, Inboard or Outboard alternatives. Speeds would be about 3 to 5 mph on all sections south of 23rd Street, although higher speeds south of Canal Street would be possible. Speeds north of 23rd Street would be 13 to 14 mph.

Under the Reconstruction alternative, northbound traffic would be subject to moderate to severe congestion and delays between Canal and 42nd Streets. There would also be delays north of 72nd Street, on the existing Henry Hudson Parkway, where the capacity is about 4,500 vehicles per hour. Speeds on the entire northbound roadway would be about 9 to 10 mph.

The Arterial alternative would provide congested flow throughout its length during the afternoon peak period. As in the morning peak, the lower operating speeds of this alternative would result in lower traffic volume, as many drivers would choose to use alternate parallel routes. Speeds would be about 3 to 5 mph south of 23rd Street, and about 13 to 15 mph between 30th and 60th Streets. As with the other alternatives, various roadway sections would be capable of operation at higher speeds, except for the effects of queuing behind bottlenecks.

Table 38 1995 West Side Highway Travel Characteristics Northbound in the Evening Peak Hour by Segment of Highway Main Line(a)

Maintenance Alternative	Speed (MPH)	V/C
North of 72nd St.	14	1.01
72nd to 55th St.	14	1.01
55th to 46th St.	14	1.00
46th to 42nd St.	22	.83
42nd to 23rd St.	14	1.00
23rd to Canal St.	3	1.45
Canal to Chambers St.	9	1.16
Chambers to Rector St.	29	.63
Rector to Brooklyn Battery Tunnel	7	.93

Reconstruction Alternative	Speed (MPH)	V/C
North of 72nd St.	10	1.14
72nd to 59th St.	24	.87
59th to 42nd St.	16	1.02
42nd to 23rd St.	9	1.16
23rd to 18th St.	23	.90
18th to Canal St.	12	1.10
Canal to Chambers St.	32	.73
Chambers to Rector St.	38	.61
Rector to Brooklyn Battery Tunnel	5	1.10

Arterial Alternative	Speed (MPH)	V/C
North of 72nd St.	15	.97
72nd to 59th St.	15	97
59th to 46th St	18	.85
46th to 42nd St.	13	.92
42nd to 34th St.	17	.92
34th to 30th St.	16	.87
30th to 23rd St.	5	1.04
23rd to 18th St	4	1.05
18th to 14th St.	4	1.02
14th to Christopher St.	4	1.08
Christopher to Canal St.	3	1.21
Canal to Chambers St.	5	.90
Chambers to Vesey St.	24	.74
Vesey to Rector St.	2	1.30
Rector to Brooklyn Battery Tunnel	20	.69

	Inboard Alternative		Outboard Alternative	
	Speed (MPH)	V/C	Speed (MPH)	V/C
North of 72nd St.	12	1.06	13	1.03
72nd to 55th St.	12	1.06	13	1.03
55th to 46th St.	7	1.25	7	1.25
46th St. to Lincoln Tunnel	9	1.15	10	1.15
Lincoln Tunnel to 14th St.	25	.86	27	.81
14th to Canal St.	20	.96	24	.88
Canal to Holland Tunnel	30	.79	32	.75
Holland Tunnel to Vesey St.	33	.73	33	.73
Vesey to Rector St.	42	53	42	.54
Rector to Brooklyn Battery Tunnel	42	.54	42	.54

(a) See Appendix for methodology used to develop volume to capacity (v/c) ratio. Estimates are based on the Minimum (b) Land Use Forecasts and reflect traffic demand without effects of Traffic Control.

Conditions on the Inboard and Outboard alternatives would be very similar to each other, but the Outboard would attract slightly lower volumes and would, therefore, provide slightly better traffic flow. In both cases, however, the lack of adequate capacity north of 42nd Street would result in queuing, congestion and delays at the point where the new facility would join the existing West Side Highway. Some queuing may also be expected on the ramps leading to the Holland and Lincoln Tunnels, caused by the limited capacities of the tunnels themselves. The roadway sections would operate at 20 to 30 mph, except for the effect of the back-up behind the bottleneck north of 42nd Street, where northbound speeds would drop to 7 to 8 mph approaching 55th Street.

In summary, for the afternoon peak northbound traffic, the Maintenance alternative would result in severe congestion, delays and speeds of 3 to 5 mph south of 23rd Street, and moderate congestion and 14 mph speeds north of 23rd Street. Reconstruction would result in congestion on the entire northbound roadway and 10 mph speeds unless a control system were used to severely limit the entrance of northbound traffic onto the facility. The Arterial would require the restriction of entering traffic south of 30th Street. The Inboard and Outboard alternatives are entirely adequate to handle all traffic demand without controls, except for queuing which would be caused by the bottleneck north of 42nd Street. To avoid resultant severe congestion and delays, intensive use of the control system would be required to smooth the transition for traffic between the new facility and the existing West Side Highway.

Northbound traffic in the morning peak is estimated to be significantly lower than in the afternoon peak. The Reconstruction, Inboard and Outboard alternatives would all operate northbound within their capacities at speeds of 20 mph or more. The only exception is the connection from the Brooklyn-Battery Tunnel to the mainline under the Reconstruction scheme, which would be at capacity, resulting in delays to traffic leaving the Tunnel.

The Maintenance alternative would experience congestion and delays and speed of about 8 mph in the entire section south of 23rd Street, caused by the sharp curves. Traffic on the Arterial would be congested with very low speeds south of Christopher Street, but north of that point traffic would flow freely. This alternative would cause severe congestion for traffic from the Brooklyn-Battery Tunnel. It would be necessary to use the control system effectively under both the Arterial and Maintenance alternatives to assure good quality of flow.

Traffic Control System

A traffic surveillance and control system is included as an integral part of the design of each alternative except Maintenance. The planning of such a system and the assessment of its capability in controlling traffic was done in response to policy statements of the Steering Committee. The system is designed to be integrated with the computer operated system which the City has planned for Manhattan, which is expected to be in operation by the time that a Project alternative would be in operation.

The system consists of vehicle detectors placed in roadways, television cameras mounted to allow remote observation of traffic, remote-controlled variable-message signs to indicate speeds and travel information, ramp metering controls, and interconnected traffic signals, all linked to a computer in a control center. The system provides information on traffic conditions at all times and provides a means to implement traffic control strategies established by policy. The general objective would be to optimize traffic movement capability of the entire street system, but with due consideration for non-traffic factors such as surrounding land uses.

At various times, it may be found desirable to divert traffic to or from specific roadways because of construction activities, an accident, unusual congestion, fires or local special events. A major purpose would be to encourage or discourage use of the highway as required to maximize its ability to move traffic.

The alternatives differ in the nature of the control strategy that would probably be developed. For Arterial and Reconstruction, the major need would be to discourage usage during peak hours to avoid back-ups. For Inboard and Outboard, however, traffic could be diverted to the highway during all periods except northbound in the afternoon peak hour.

The roadway configurations for the alternatives differ regarding ability to effectively divert traffic to alternative routes. The Inboard and Outboard plans include reconstruction of West Street, which would become a parallel, continuous alternative route, with capacity adequate to accommodate diverted traffic on an intermittent basis.

Less flexibility is available with the Reconstruction alternative. The lower capacity of this alternative results in greater need for ramp metering and diversion of traffic during peak hours. However, the ramp design does not permit maximum utilization of the ramp metering aspect of the traffic control system. Also, West Street is not attractive as a diversionary route. This results in less desirable overall operation of the combined roadways.

The operational strategies available with the Arterial alternative are even less flexible than with Reconstruction. Since ramps are not a part of this alternative, there is no ramp metering. The control of access to the mainline would be accomplished through control of the traffic signals at intersections with the Arterial. This is similar to the planned control system to be utilized for the remainder of the City's street system. The discontinuous service road with the Arterial alternative would not be a convenient parallel route to accommodate the traffic waiting to get on the mainline. A route consisting of the service road and local streets could be used, but with less than desirable operational results. In addition, the metering of traffic onto the mainline could result in some back-up on side streets, since there are no ramps on which to store vehicles.

Through Traffic Analysis

The policy of discouraging vehicles whose origins and destinations are both outside Manhattan from using Manhattan streets is emphasized in the Project policies. Such vehicles add to the congestion and adverse environmental effects of travel in Manhattan, and are not directly related to the support of activities in the CBD.

A special analysis was carried out, using data from the Port Authority, to determine whether any Project alternative would cause changes in time and toll costs in sufficient magnitude to attract more traffic through Manhattan. The analysis, done separately for autos and trucks, was based upon eastbound trips. It was assumed, based on Port Authority experience, that westbound trips are essentially the same volume on an average daily basis.

On an average weekday, 64 percent of the 98,000 eastbound vehicles crossing the George Washington Bridge continue to destinations without stopping in Manhattan. Of the 40,000 vehicles per day entering Manhattan through the Lincoln Tunnel, 29 percent continue to East River crossings without stopping in the CBD. Volume through the Holland Tunnel is 28,100 vehicles, with 48 percent continuing through Manhattan without intermediate stops. In addition, more than 80 percent of the through trips using both the Lincoln and Holland Tunnels are bound for Brooklyn and Queens.

Preliminary analysis indicated that trips crossing the George Washington Bridge would not be affected by any alternative. It also showed that the Reconstruction and Arterial alternatives would have little or no effect on through traffic using the tunnels, primarily because they are not directly connected by ramps to the tunnel portals.

The Inboard and Outboard alternatives each have direct ramp connections to the Lincoln and Holland Tunnels. Also, the operating speeds on the highway itself would be significantly higher with these alternatives. The combined effect would be to reduce travel times between the Lincoln and Holland Tunnels and the Brooklyn-Battery Tunnel. These alternatives would also provide a highway route between Hudson County in New Jersey, and Brooklyn, bypassing congested Manhattan streets.

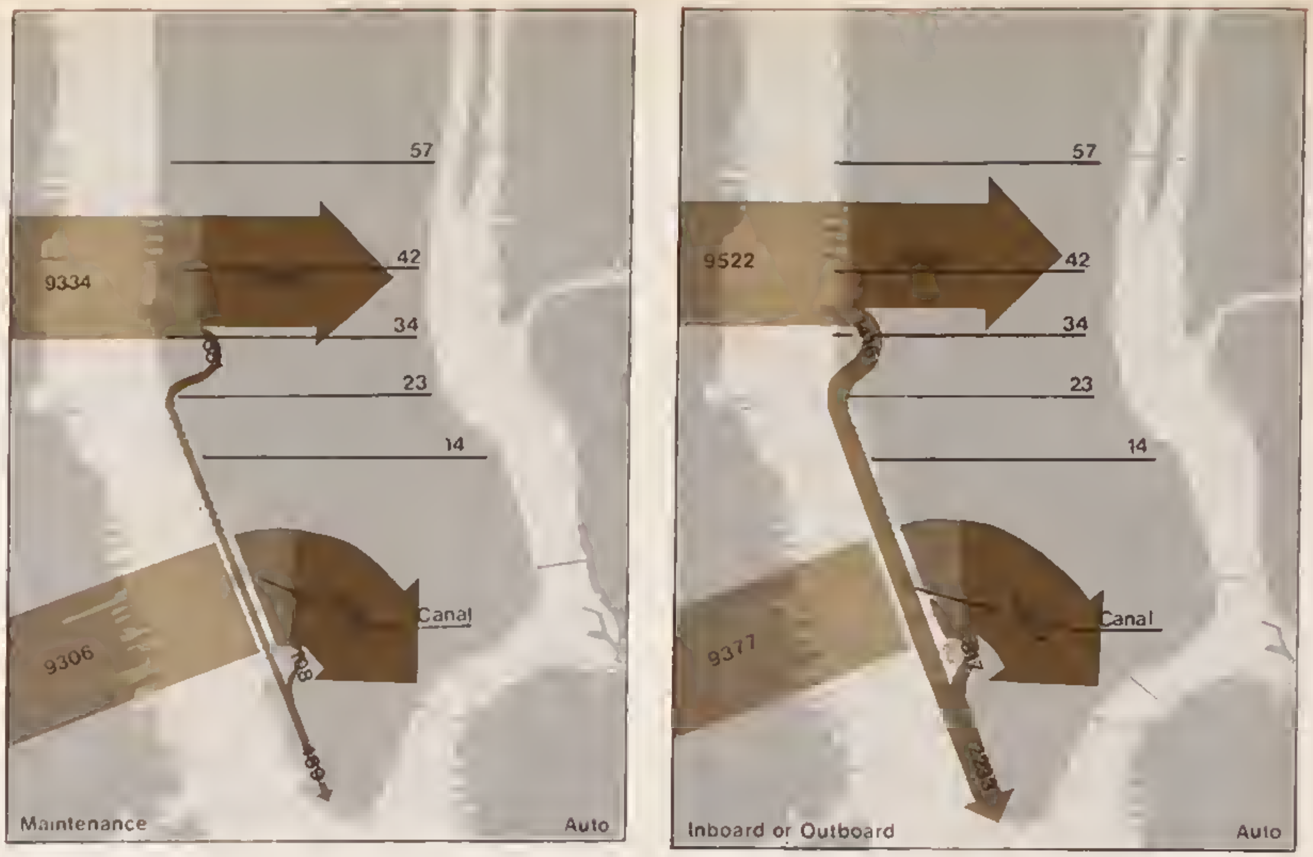
Illustration 72 Daily Eastbound Through Auto Traffic Volumes In 1995

▨ Volume on the West Side Highway

▨ Volume on Local Streets

▨ Total Volume

North



As shown in Illustrations 72 and 73, the highway route provided with the Inboard and Outboard alternatives would attract trucks from other routes that presently use Manhattan streets. These diversions would result in a six percent decrease in the number of through trucks using Manhattan streets. However, this route would not be as attractive to trucks now using the Verrazano Narrows Bridge; estimated diversions from the bridge to the Manhattan tunnels and the Inboard or Outboard alternatives would be less than one percent.

The all-highway route would also cause diversion of through auto trips from other routes presently using local streets in Manhattan. Illustrations 73 and 74 show 1995 through auto volumes for the Maintenance, Inboard, and Outboard alternatives. The number of through autos using the Lincoln and Holland Tunnels and local streets would be eight percent less with the Inboard and Outboard alternatives than with the Maintenance, Reconstruction, and Arterial alternatives. Diversion of autos from the Verrazano Narrows Bridge would be less than two percent.

The above analysis assumed that there would be no change in bridge and tunnel tolls between 1972 and 1995. Thus, the diversion of through trips from Manhattan streets to the route using direct ramp connections to the West Side Highway and the Brooklyn-Battery Tunnel occurs in spite of the assumption that the Manhattan, Brooklyn and Williamsburg Bridges would be free. Thus, time savings would more than compensate for the additional out-of-pocket cost of the Brooklyn-Battery Tunnel toll. The imposition of tolls on all East River crossings would be likely to further decrease the number of autos and trucks using the local streets to travel through Manhattan. Similarly, given the small number of vehicles estimated to shift from the Verrazano Narrows Bridge to the Brooklyn-Battery Tunnel, only a minor reduction in the Verrazano Narrows toll would be required to reverse this effect and reduce the magnitude of through traffic in Manhattan.

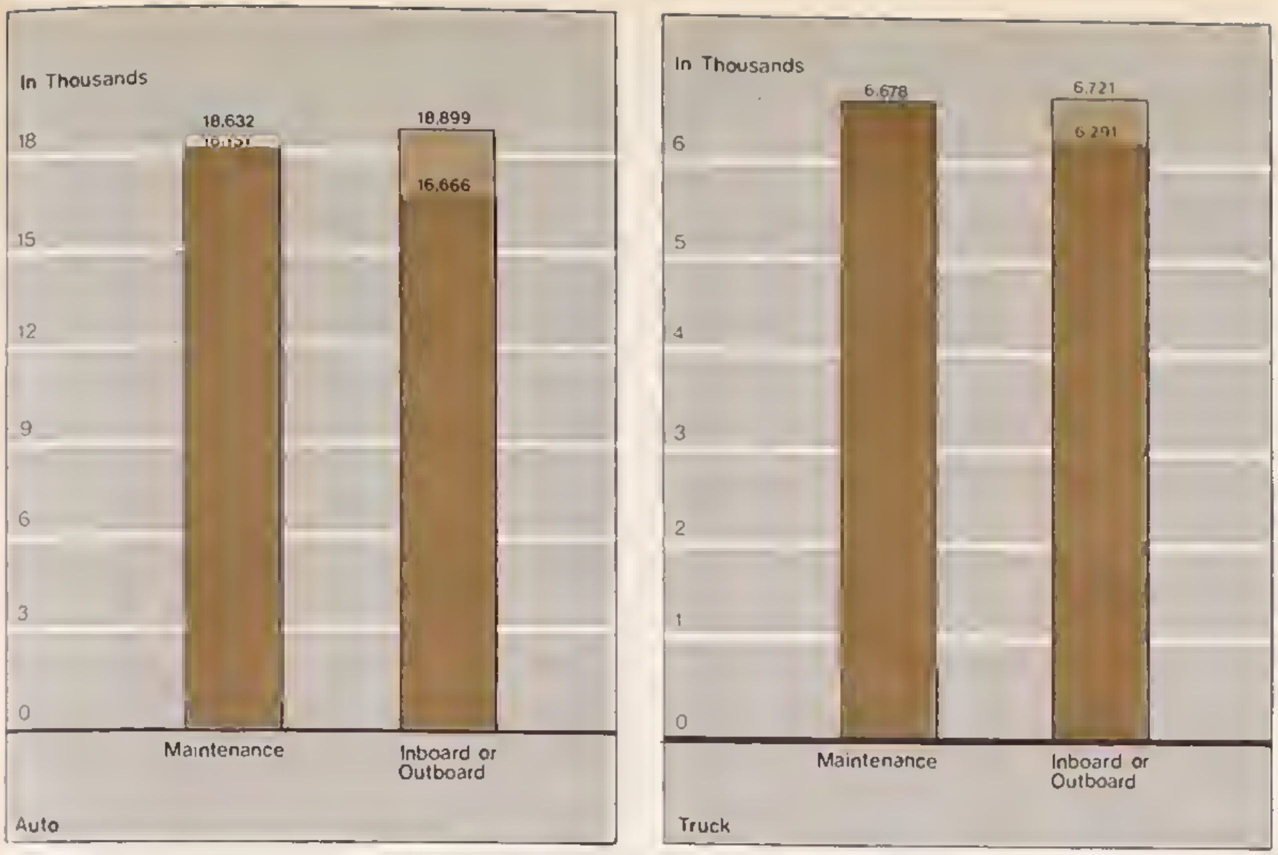


Illustration 73 Total Eastbound Through Traffic Volumes in 1995

▨	Volume on the West Side Highway
■	Volume on Local Streets
□	Volume on the West Side Highway via Local Streets

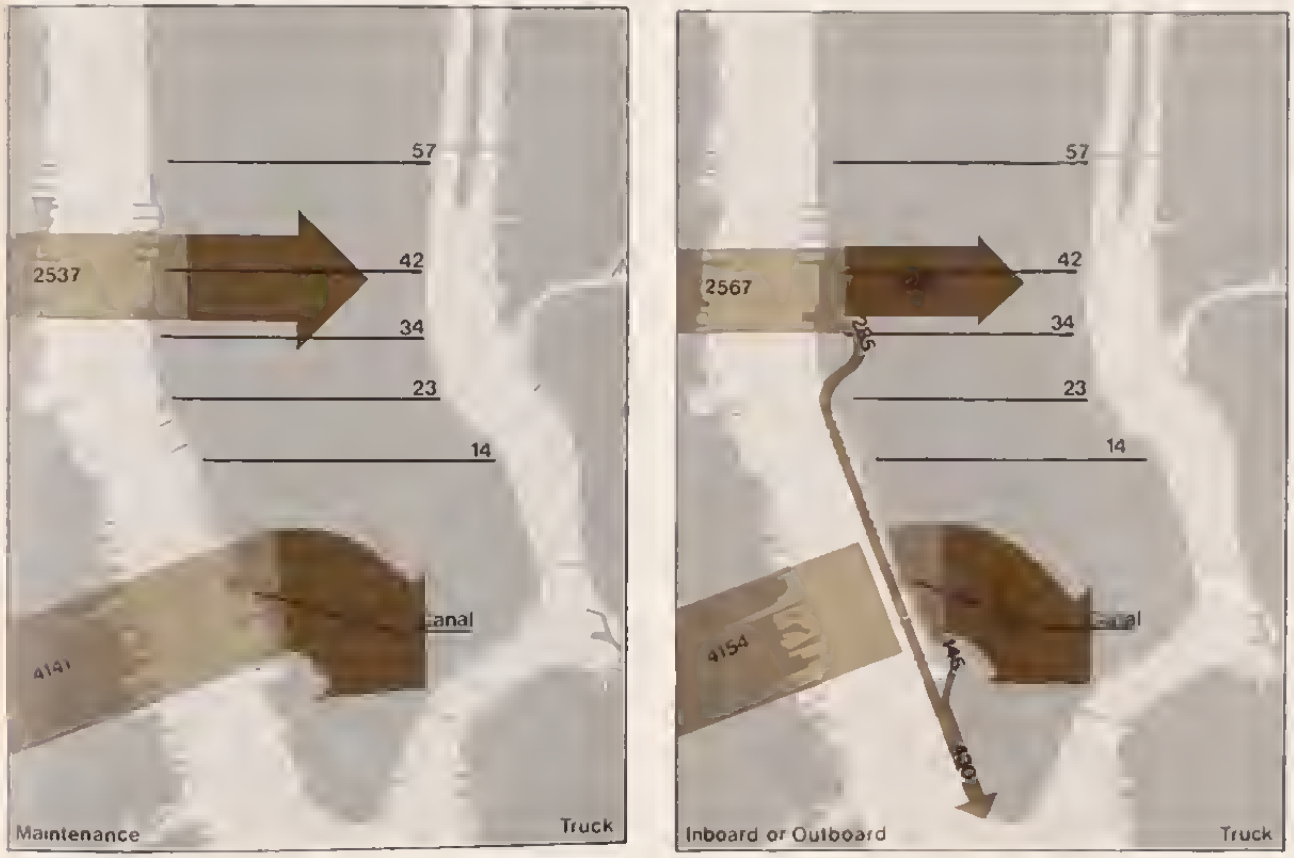


Illustration 74 Daily Eastbound Through Truck Traffic Volumes in 1995

▨	Volume on the West Side Highway
■	Volume on Local Streets
□	Total Volume
○	North

Peak Hour Congestion

The effect of alternatives for areas containing many local streets is summarized by the use of two standard aggregate measures of travel conditions—Vehicle miles of travel (VMT) and vehicle hours of travel (VHT). One vehicle mile of travel represents a single vehicle traveling one mile. The VMT in an area is the sum of the miles traveled by each vehicle on the streets in that area. One vehicle hour of travel represents a single vehicle traveling for one hour. The VHT in an area is the sum of the time spent (in hours) by all vehicles traveling on the streets within that area. The average speed of vehicles in the area (in miles per hour) is equal to the vehicle miles of travel in the area divided by the vehicle hours of travel.

In this section, estimates of vehicle miles of travel, vehicle hours of travel, and average speed in the afternoon peak hour, when congestion is at its worst, are used as a basis for describing differences between alternatives in their effects on local streets in the Study Corridor. Table 39 summarizes the vehicle miles of travel, vehicle hours of travel, and average speed on Impact area arterial streets within the study area for each project alternative. The information is also divided into north-south and east-west travel categories. The generally lower speeds for east-west travel indicate the extent to which operation of the Manhattan street system favors travel in the north-south direction.

A comparison of 1972 conditions with those which would occur in 1995 with the Maintenance alternative indicates a general worsening of the situation. The reduction in average speed would be due to increased traffic generated by changes expected in population and employment within Manhattan by 1995. The street and highway network for the 1995 Maintenance alternative would be virtually identical to the 1972 network.

Traffic conditions with the Reconstruction alternative would improve only slightly when compared to Maintenance. The improvement in the north-south direction would be due to the fact that correcting some design deficiencies and allowing trucks on the new highway mainline would divert some north-south vehicles from local streets.

Conditions with the Arterial alternative would not be significantly different from the Maintenance. This is true despite the fact that the volume of auto travel to the Manhattan CBD would be lower than for Maintenance or Reconstruction because of the diversion of some automobile trips to the mass transit facilities provided by the Arterial alternative.

Table 39 **1972 and 1995 Total Vehicle Miles of Travel (VMT) and Vehicle Hours of Travel (VHT) and Average Speeds on Arterials in the Impact Area in the Evening Peak Hour(a)**
VMT and VHT in thousands

	Maintenance		Reconstruction	Arterial	Inboard	Outboard
	1972	**1995**				
Northbound and Southbound						
VMT	37.0	42.9	41.5	43.1	37.2	37.5
VHT	4.9	6.8	5.9	7.0	4.7	4.8
Average Speeds	7.6	6.3	7.0	6.2	7.9	7.8
Eastbound and Westbound						
VMT	31.0	35.2	35.6	34.4	33.9	34.1
VHT	5.1	6.8	6.9	6.8	5.7	5.7
Average Speeds	6.1	5.2	5.2	5.1	5.9	6.0
Total						
VMT	**67.9**	**78.1**	**77.1**	**77.5**	**71.1**	**71.6**
VHT	**10.0**	**13.6**	**12.8**	**13.7**	**10.3**	**10.5**
Average Speeds	**6.8**	**5.7**	**6.0**	**5.7**	**6.9**	**6.8**

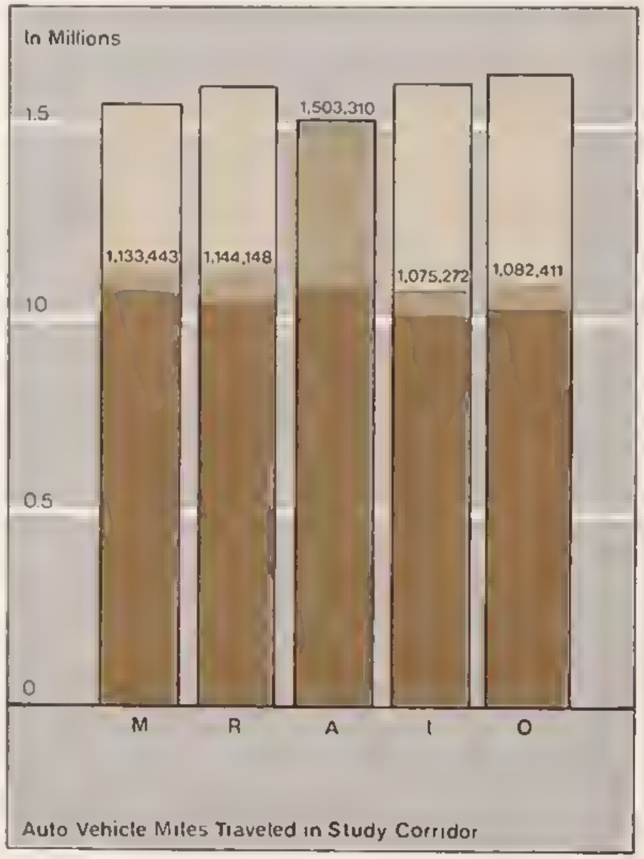
(a) Arterials include all streets in Impact Area excluding West Street. See Appendix for map of Impact Area. VMT and VHT based on traffic assignments developed from Minimum (8) Land Use Forecasts.

Illustration 75 **Daily Automobile Vehicle Miles of Travel in 1995**

▭ Vehicle Miles of Travel on the West Side Highway

▨ Vehicle Miles of Travel on West Street

■ Vehicle Miles of Travel on Local Streets



Auto Vehicle Miles Traveled in Study Corridor

Both the Inboard and Outboard alternatives would provide significant improvements on study area streets, compared with the Maintenance alternative. This is true in both the north-south and east-west directions. The improvement in the north-south direction would be due in part to diversion of some auto trips to the new transit facility component of these alternatives, but primarily to improvements in highway mainline and West Street capacities. This can be seen by comparing the Inboard and Outboard with the Arterial. All three include transit facilities, and have approximately the same diversion from autos to transit. The improvement in east-west traffic on study area streets with the Inboard and Outboard would be due to the provision of highway ramp connections at the Lincoln and Holland Tunnels.

Examination of VMT, VHT and average speed information shows the same general effects for each community within the Corridor, as shown in Table 40:

- A worsening of conditions from 1972 to 1995 with the Maintenance Alternative.
- No significant difference between the Maintenance and Arterial alternatives.
- A slight improvement with the Reconstruction alternative.
- Larger improvements with the Inboard and Outboard alternatives.

The effect is most pronounced in Community Planning District Two (Greenwich Village), where speeds on local streets would increase from an average of 5.6 mph with the Maintenance alternative, to an average of 8.5 mph with the Inboard alternative. At the same time, vehicle miles of travel in the afternoon peak hour would decline from 19,000 VMT with Maintenance to 16,200 VMT with Inboard.

The VMT and VHT summaries were prepared from the results of the computer traffic simulation process which assigned traffic to the main highway in excess of capacity at some locations, and below its capacity at other locations in each alternative. Therefore, to the extent that the control system would be used to divert traffic to or from the highway, the estimates of arterial street usage are overstated or understated. For example, on both the Inboard and Outboard alternatives northbound in the afternoon peak hour, the demand between the northbound entrance from 46th Street and the exit at 55th Street is about 5,200, while the capacity is only 4,200. If this 1,000 car "excess" were on the arterial system for an average distance of one mile in the District Four (Chelsea and Clinton) area, this would add 1,000 vehicle miles of travel to the VMT values shown in Table 40, diminishing the difference among the alternatives. Except for this short roadway section, the over-assignment to the unimproved section of the Inboard and Outboard north of 42nd Street is about 600 vehicles in the afternoon peak hour.

Table 40 **1972 and 1995 Total Vehicle Miles of Travel (VMT) and Vehicle Hours of Travel (VHT) and Average Speeds on Arterials in Community Planning Districts One, Two, and Four in the Evening Peak Hour(a)**
VMT and VHT in thousands

	Maintenance		Reconstruction	Arterial	Inboard	Outboard
	1972	1995				
Planning District One						
VMT	14.6	19.1	18.4	17.7	17.3	17.1
VHT	2.8	4.5	3.9	4.2	3.6	3.3
Average Speed	5.2	4.2	4.7	4.2	4.8	5.2
Planning District Two						
VMT	16.7	19.0	19.2	20.1	16.2	16.7
VHT	2.3	3.4	3.5	4.0	1.9	2.2
Average Speed	7.3	5.6	5.5	5.0	8.5	7.6
Planning District Four						
VMT	20.3	22.8	22.5	22.2	20.8	20.7
VHT	2.8	3.1	3.0	3.0	2.4	2.5
Average Speed	7.2	7.4	7.5	7.4	8.7	8.3

(a) Arterials include all streets in Impact Area excluding West Street. See Appendix for map of Impact Area. VMT and VHT based on traffic assignment developed from Minimum (B) Land Use Forecasts. Community Planning District totals do not equal the Impact Area total. See Appendix for analysis.

In the Community Planning District Two area, the assignment process resulted in demand estimates above capacity for the Maintenance, Reconstruction and Arterial facilities, but under capacity for the Inboard and Outboard. In this case, traffic management would result in VMT on the arterials higher than shown on Table 40 for the first three alternatives, and lower than shown for the Inboard and Outboard. The advantages of the latter two, then would be greater than shown on that table.

The highway facility demand estimates in the District One area (Lower Manhattan) exceed capacity of the Maintenance and Arterial alternatives, but are within the capacities of the other three proposals. The net effect is that the advantages of the Reconstruction, Inboard and Outboard alternatives in Lower Manhattan are moderately understated by the VMT summaries shown on Table 40.

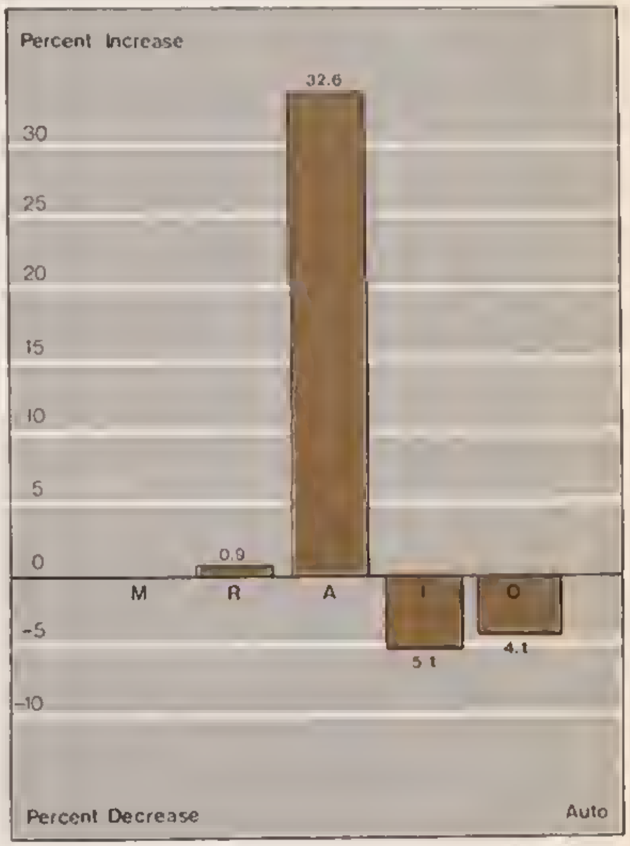


Illustration 76 Percent Difference in Auto Vehicle Miles of Travel on Local Streets Between Maintenance and Other Alternatives in 1995

Traffic on Local Streets

The diversion of auto and truck traffic from local communities and the improvement of traffic flow on directly affected local streets were established as Project policy objectives at an early stage. The differences between alternatives are discussed in three different contexts:

- The distribution of traffic crossing a "screenline."
- The vehicle miles of travel (VMT), vehicle hours of travel (VHT), and average speed and their relation to peak-hour congestion.
- Specific locations with particularly significant traffic problems, including local streets which provide tunnel access.

Screenline Analysis

A screenline can be understood as an imaginary line drawn across Manhattan from river to river. Screenlines were drawn at three locations: (1) just south of 51st Street; (2) south of 18th Street; and, (3) in the vicinity of Chambers Street. The magnitude and distribution of traffic among the north-south streets and highways crossing each screenline were estimated in the computer assignment procedures. Differences in the total number of vehicles crossing each screenline are primarily a reflection of the assumed land uses and the transit components associated with each alternative. However, the distribution of traffic crossing a screenline between the highway and local streets reflects the extent to which each alternative diverts traffic from local streets. Separate screenline analyses were carried out for autos and heavy trucks.

Based on the 24-hour screenline auto totals seen in Illustration 77, the alternatives fall into two groups: (1) Inboard and Outboard; and (2), Maintenance, Arterial and Reconstruction. Within each group, the number of autos crossing the screenlines on the West Side on the arterials is similar, with the Inboard and Outboard reducing volumes on the arterials more than the other alternatives. This is the case at all three screenlines, with the greatest reduction occurring in Lower Manhattan at the Chambers Street screenline, and the least at the 51st Street screenline.

The main highways of the Inboard and Outboard alternatives would carry the greatest traffic volumes, with the Maintenance accommodating the least. West Street, except with the Arterial, would carry similar traffic volumes at each screenline for all the alternatives. With the Arterial alternative, all vehicles would be at grade, similar to West Street in the other four alternatives. This would produce the dramatic increase in West Street traffic and the lack of mainline volume shown with the Arterial. However, except at the 18th Street screenline, where they are higher, the traffic volumes on arterials at the screenlines with the Arterial are the same as the Maintenance and Reconstruction alternatives.

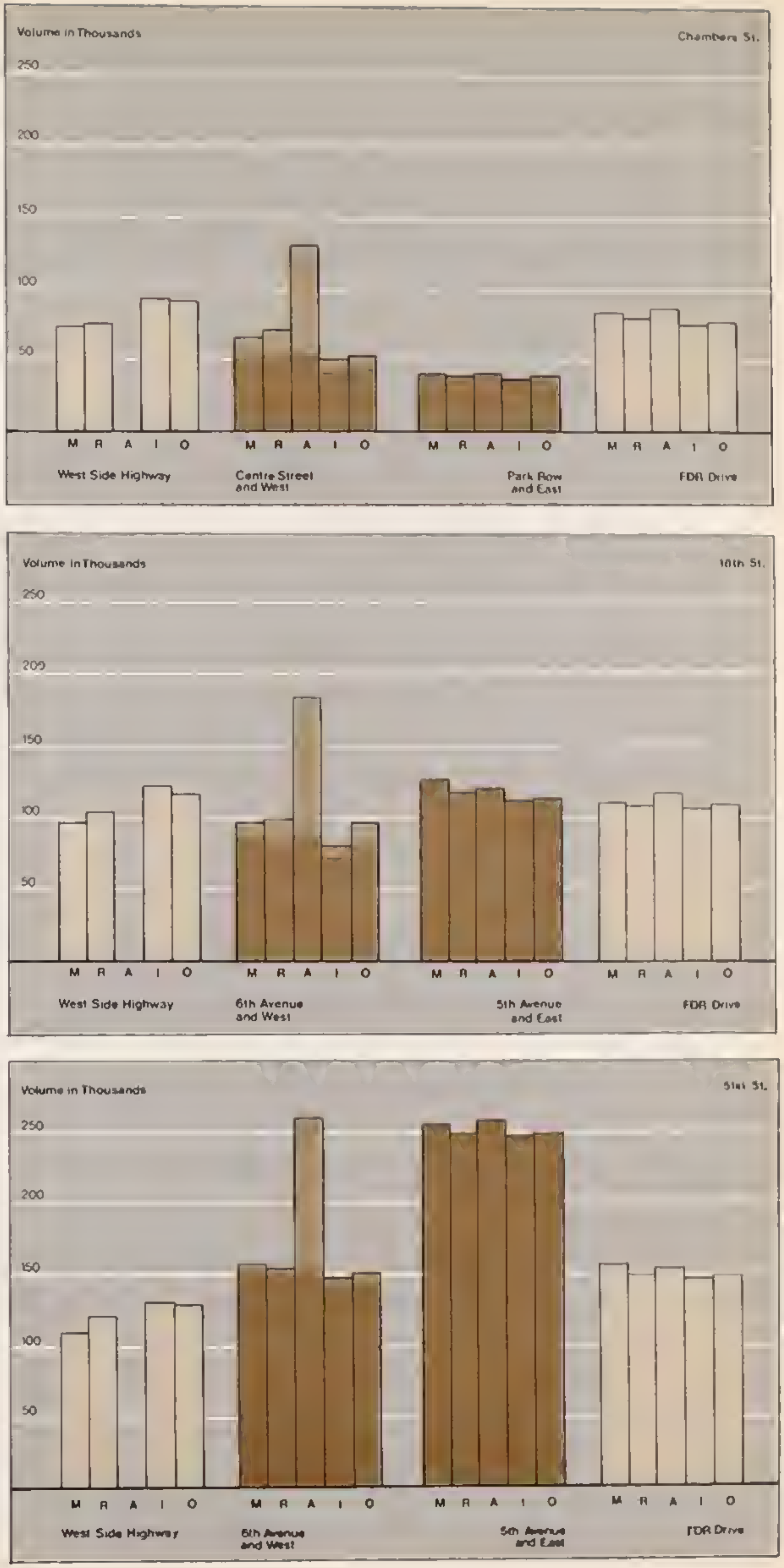
Illustration 77 Daily Northbound and Southbound Screenline Auto Volumes In 1995(a)

▭ Volumes on Highway

▨ Volumes on West Street

■ Volumes on Local Streets

(a) M: Maintenance Alternative
R: Reconstruction Alternative
A: Arterial Alternative
I Inboard Alternative
O: Outboard Alternative



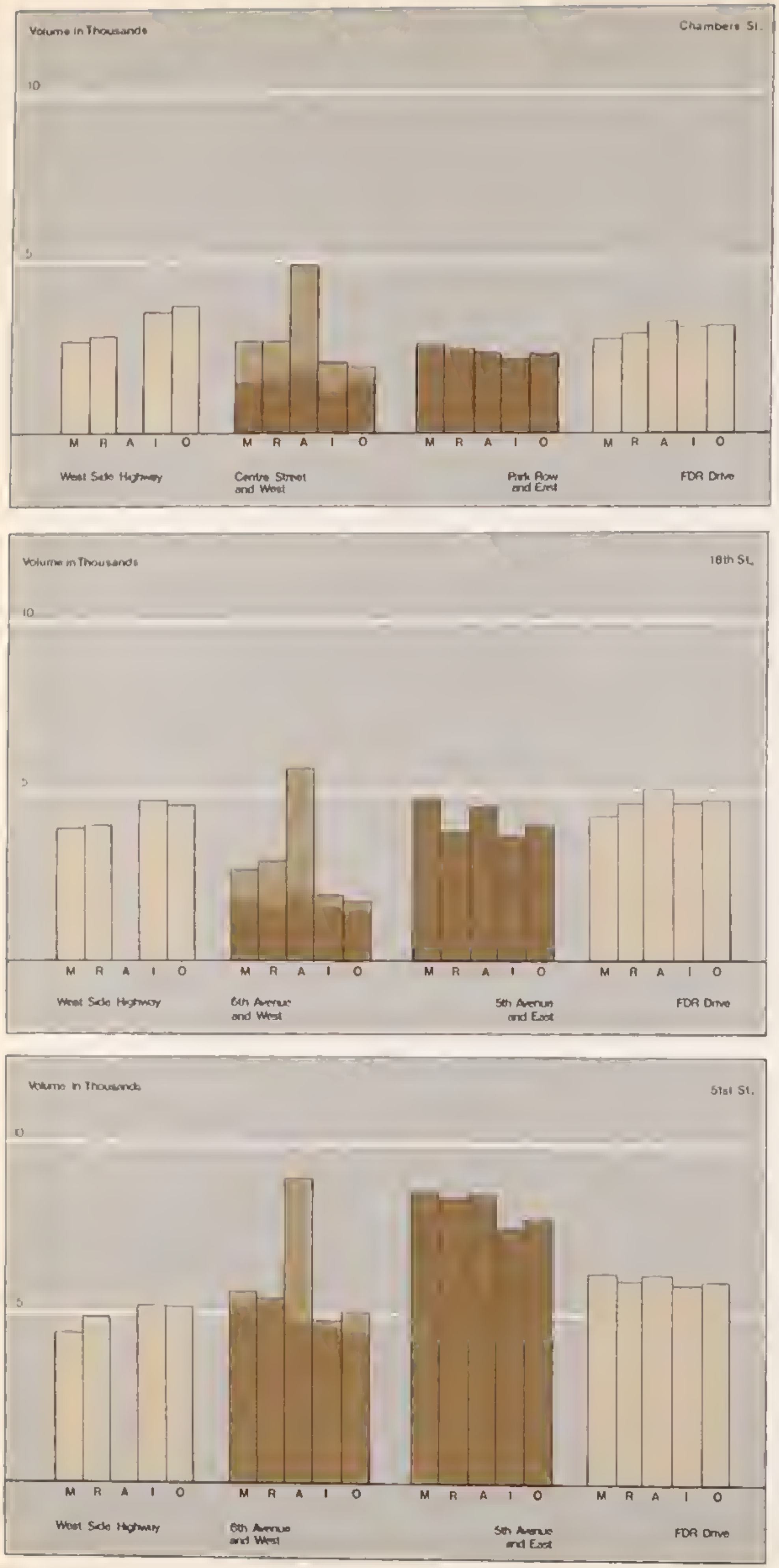


Illustration 78 **Morning Peak Hour Southbound Screenline Auto Volumes in 1995**

▭ Volumes on Highway

▨ Volumes on West Street

■ Volumes on Local Streets

While some minor variations appear in the two peak-hour screenline distributions, the same general relationships are observed. Generally less traffic is on arterials crossing the screenlines with the Outboard and Inboard than with the other three alternatives, as shown in Illustrations 78 and 79. One exception to this is in Lower Manhattan at the screenline with the Inboard and Outboard alternatives.

Besides the decrease in traffic volumes on West Side arterials, small decreases are noted for the FDR Drive and the arterials on the East Side of Manhattan with the Inboard and Outboard. While this is observed at each screenline, the greatest decreases are at 18th Street. This indicates the extent to which the proposed traffic improvements on the West Side would divert traffic from East Side arterials and the FDR Drive.

Truck traffic distribution across the screenlines has somewhat different patterns than autos, which reflects the variation among alternatives of the mainline truck capability. The Maintenance has no provisions for trucks. The Inboard and Outboard allow trucks only south of 42nd Street. On the Reconstruction, 57th Street is the northern limit for trucks, and on the Arterial, no trucks could go north of 72nd Street. Because of this, the truck distribution at the 51st Street screenline requires special analysis.

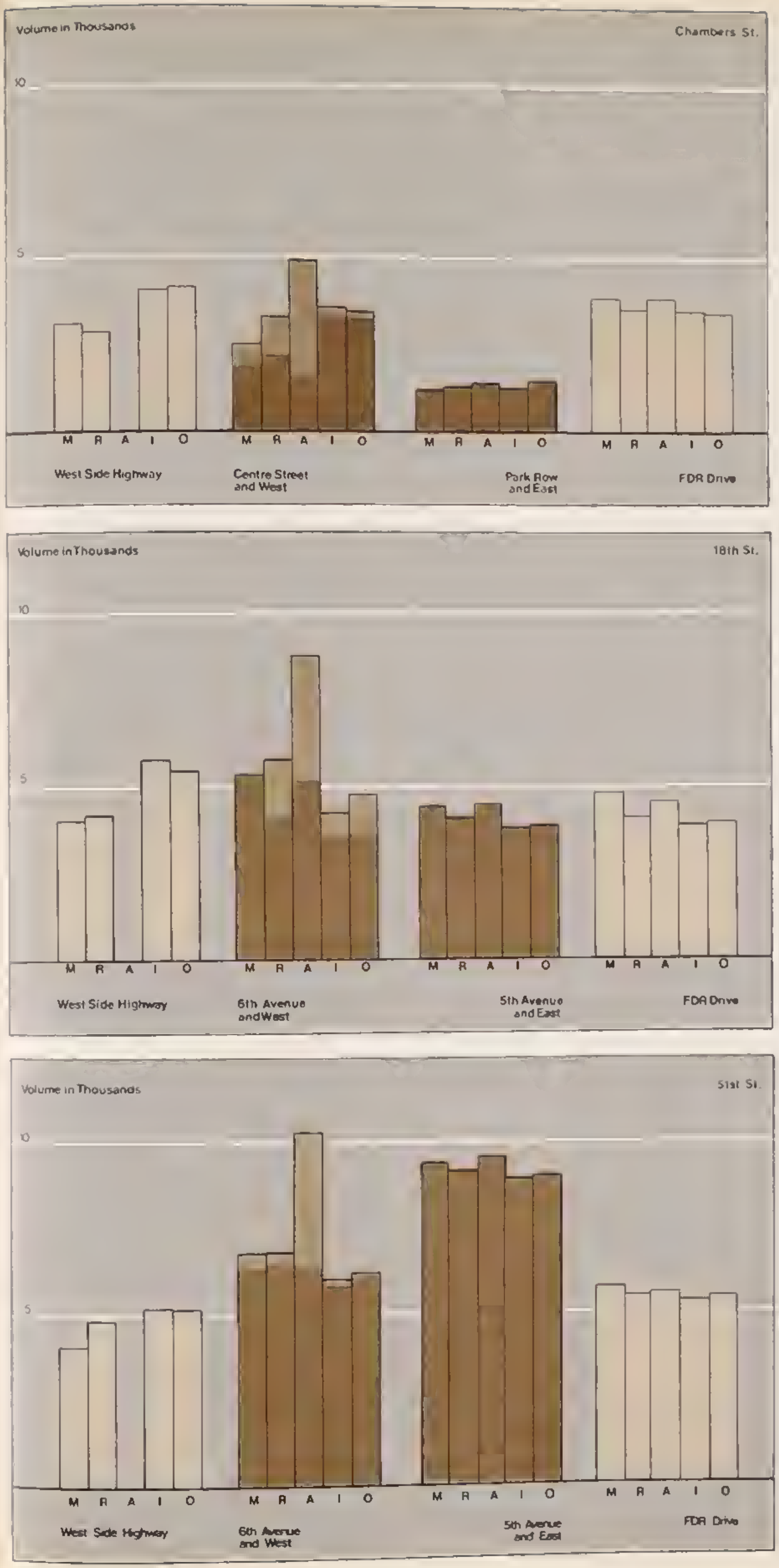


Illustration 79 Afternoon Peak Hour Northbound Screenline Auto Volumes in 1995

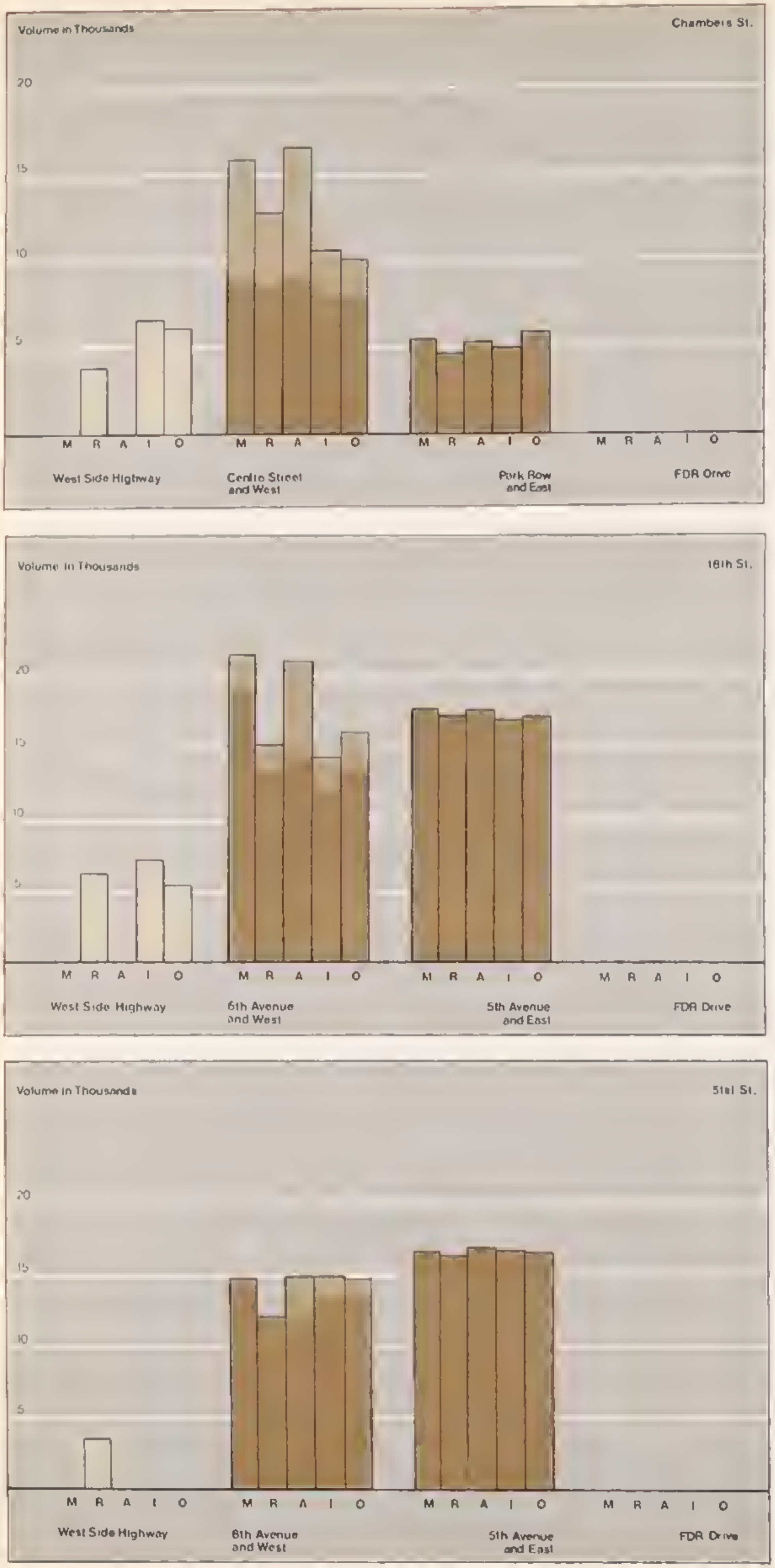
▭ Volumes on Highway

▨ Volumes on West Street

■ Volumes on Local Streets

At the other two screenlines, except for Maintenance, the 24-hour truck volumes on arterials are similar, although the Inboard and Outboard are consistently lower. The Maintenance has volumes on arterials similar to the others at the Chambers Street screenline, but substantially more at the 18th Street screenline. This results since West Street is not a continuous northbound route at this location.

Illustration 80 Daily Northbound and Southbound Screenline Truck Volumes in 1995



▭ Volumes on Highway

▨ Volumes on West Street

■ Volumes on Local Streets

The distribution of truck traffic between the mainline and West Street (with the Arterial street and service roads counted as West Street) varies considerably among alternatives. The main point is whether the trucks would be at the level of West Street, or on a highway that is either elevated or depressed. There would be more trucks on West Street with the Maintenance and Arterial alternatives. Similar truck volumes would be carried with the other three alternatives, although the Inboard and Outboard would have less than the Reconstruction at the Chambers Street screenline, and slightly more at 18th Street.

At the 51st Street screenline, the Reconstruction and Arterial would result in less truck traffic on the arterials than the Maintenance, Outboard and Inboard. The Inboard and Outboard, however, would have less than the Maintenance, since more trucks would be on West Street heading to or from the new highway ramps south of 42nd Street. (See Illustration 80.)

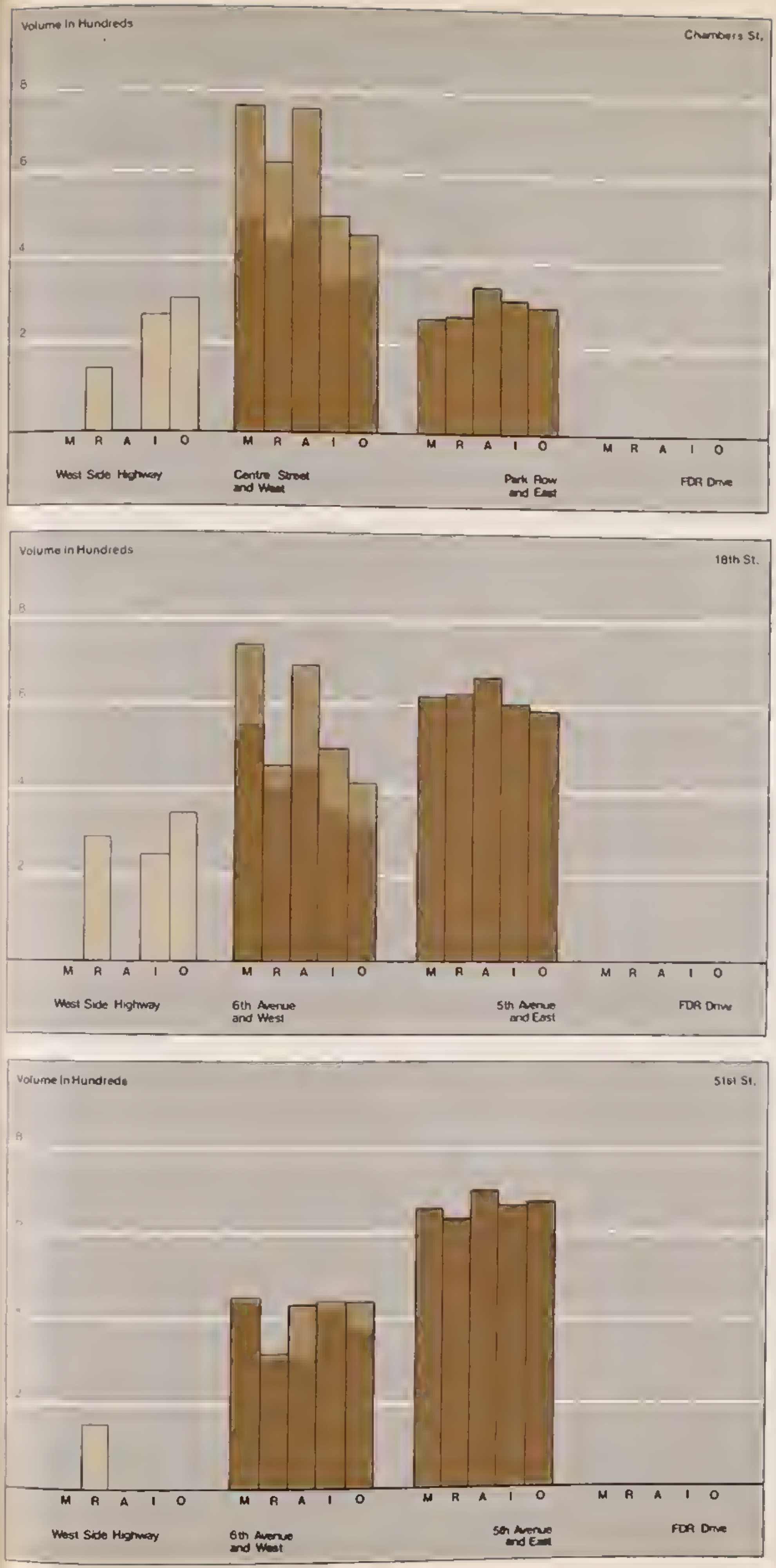


Illustration 81 Morning Peak Hour Southbound Screenline Truck Volumes In 1995

▭ Volumes on Highway

▨ Volumes on West Street

■ Volumes on Local Streets

At all three screenlines, truck volumes on arterials east of Fifth Avenue are similar, and would not be affected by the Project proposals. The same relative ranking among alternatives is maintained during the morning rush hour (Illustration 81). During the evening rush hour, however, the distribution of truck traffic between arterials and highway is different, as is the ranking of alternatives by truck volume on arterial streets. The 18th Street screenline indicates the greatest differences, as seen in Illustration 82.

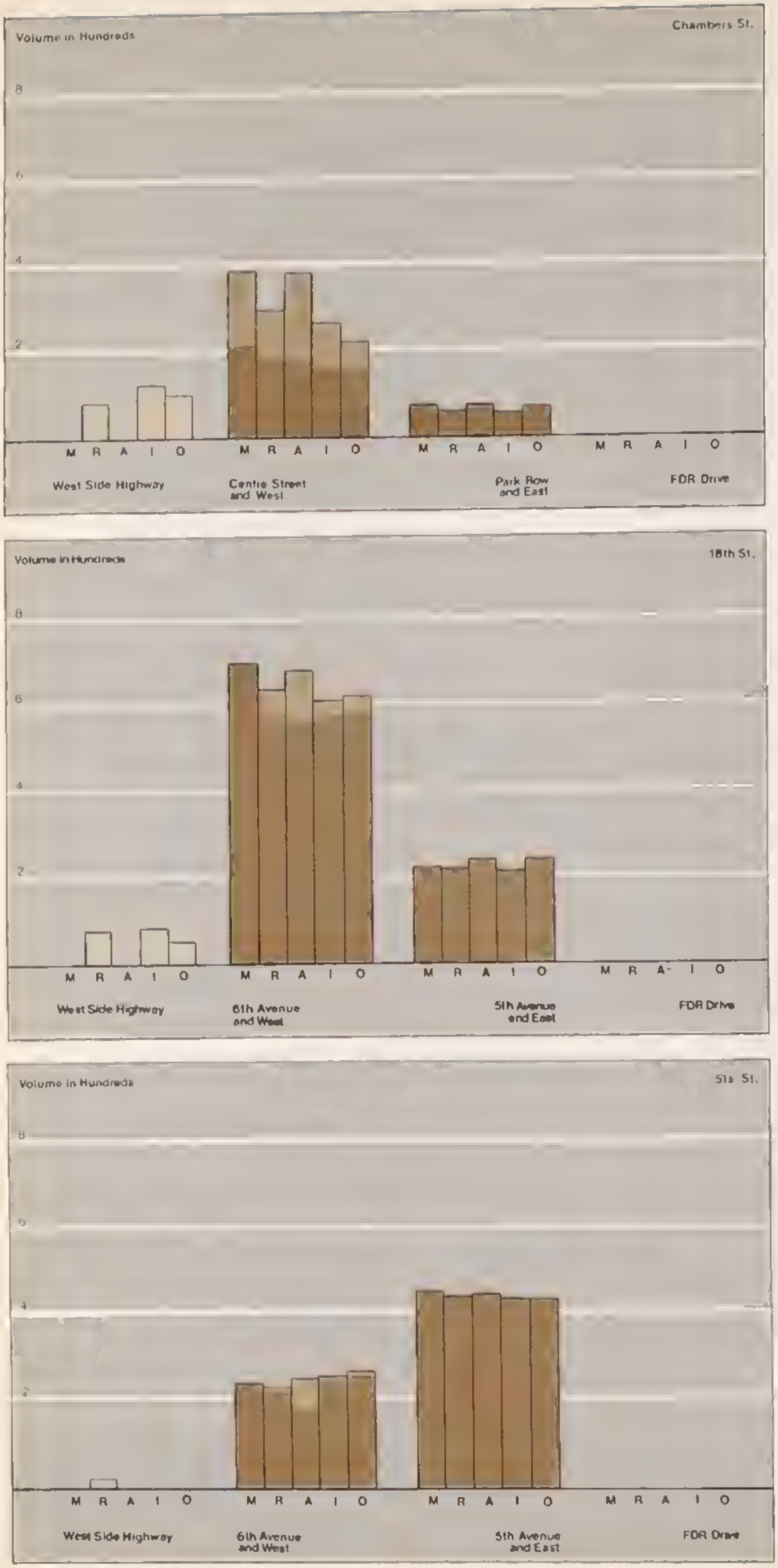


Illustration 82 **Afternoon Peak Hour Northbound Screenline Truck Volumes in 1995**

▢ Volumes on Highway

▨ Volumes on West Street

■ Volumes on Local Streets

Table 41 1995 Mainline Volume Capacity (V/C) Ratios at Screenlines (Morning and Evening Peak Hours)(a)

	Maintenance	Reconstruction	Arterial	Inboard	Outboard
Chambers Street					
Morning Southbound	0.92	0.78	1.04	0.46	0.51
Evening Northbound	1.16	0.73	0.90	0.73	0.73
18th Street					
Morning Southbound	1.37	1.10	1.05	0.85	0.73
Evening Northbound	1.45	0.90	1.02	0.86	0.81
51st Street					
Morning Southbound	1.04	0.98	1.07	1.24	1.23
Evening Northbound	1.00	1.02	0.85	1.25	1.25

(a) See Appendix for methodology used to develop volume to capacity ratios.

The key difference is that, compared to the morning peak hour, less of the truck traffic would be on the highway during the evening rush hour. This is due primarily to the highway capacity being absorbed by the heavy auto demand northbound in the evening. The result is that while there would be less total trucks crossing the screenline, the volume of trucks on the arterial streets would be higher.

Another result of the mainline of the Inboard, Outboard and Reconstruction, operating close to capacity is that it would be relatively less attractive to trucks during the evening peak hour than during the morning peak hour. The distribution of the arterial truck volumes with these three alternatives during this evening period would be similar to that resulting from the Maintenance and Arterial alternatives on a 24-hour basis, or southbound during the morning peak period.

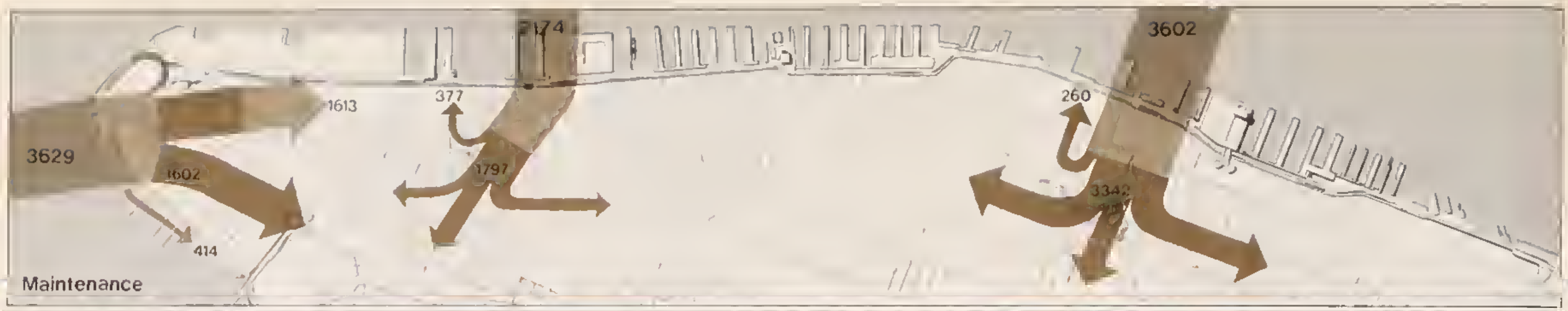
In summary, the screenline analysis indicates the same general conclusions as the VMT-VHT analysis. The Inboard and Outboard Alternatives would improve conditions on arterials by means of a modest reduction in traffic. The extent of this reduction varies by location and time period, with more reduction occurring in peak periods, as opposed to the remainder of the day, and at the Chambers Street screenline as compared to other screenline locations. While these general conclusions would be the same for trucks for the area south of 42nd Street, the Reconstruction and Arterial would more effectively reduce truck volumes on arterial streets because, at 51st Street, the other alternatives make no provisions for trucks.

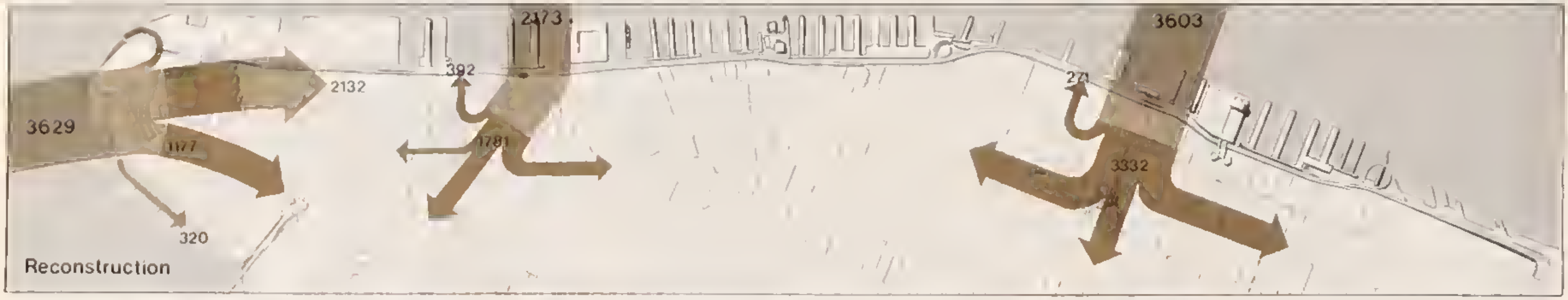
Conclusions to be drawn from the screenline analysis are affected by the degree to which the estimates of traffic demand on the Project mainline roadways are above or below the roadway capacity at various locations in the morning and afternoon peak hours. Demand volume-capacity ratios for the mainline roadways at the screenlines are summarized on Table 41. In operation, the control system could be used to divert "excess" demand (where v/c ratios are greater than 1.0) onto West Street or the arterial streets, and to divert traffic from the arterial streets to the Project roadways where there is "excess" capacity (where v/c ratios are less than 1.0).

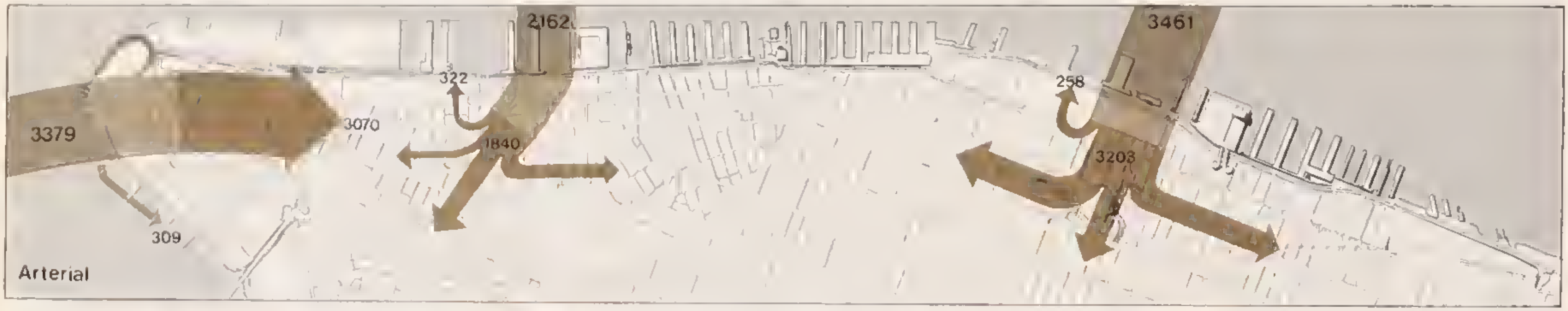
Tunnel Access

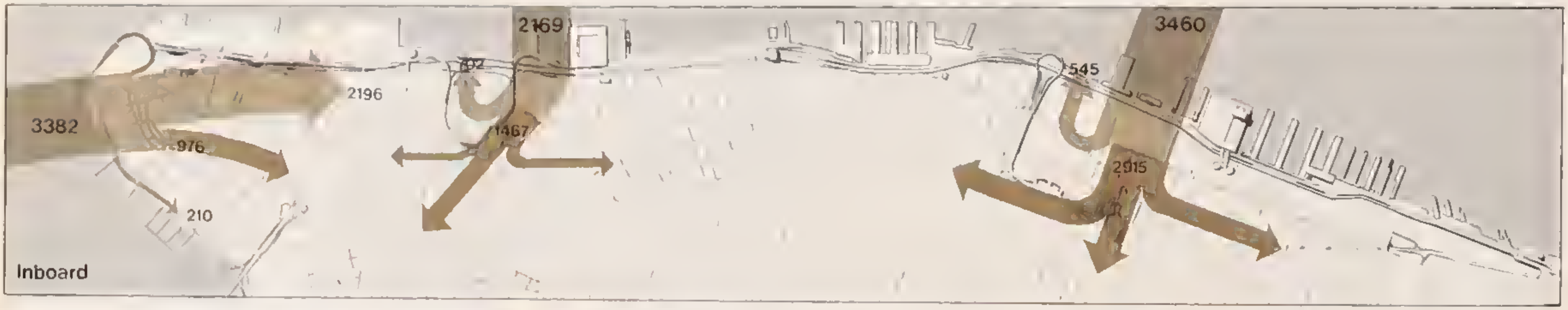
The Steering Committee emphasized the potential of Project alternatives to collect and distribute Manhattan traffic to and from the Lincoln, Holland and Brooklyn-Battery Tunnels. The extent to which each alternative would realize this potential is measured in terms of the number of vehicles which travel directly from the tunnels to the highway in the morning peak hour. This is shown for each alternative in Illustration 83.

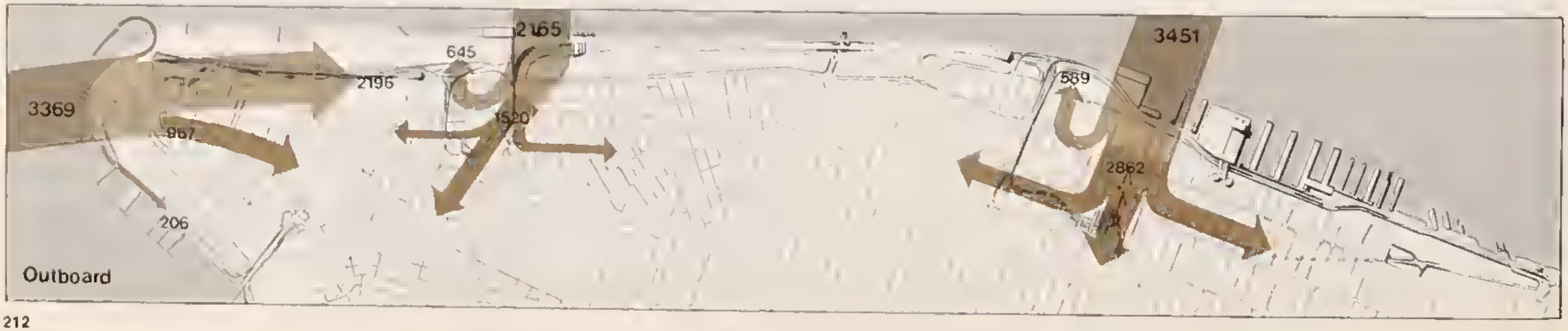
Compared to the Maintenance alternative, the Reconstruction alternative offers some improvement in terms of the number of vehicles which go to the highway instead of local streets. From the Lincoln and Holland Tunnels, the difference is not significant but from the Brooklyn-Battery Tunnel, about 2,100 vehicles would use the highway with the Reconstruction alternotive, as compared with about 1,600 with the Maintenance. The Arterial alternative is not significantly different from Reconstruction in the number of vehicles attracted from the tunnels.


2174
3602
1613
377
260
3629
1602
1797
3342
414
Maintenance


2173
3603
2132
392
271
3629
1177
1781
3332
320
Reconstruction


2162
3461
322
258
3379
3070
1840
3203
309
Arterial


2169
3460
392
545
2196
3382
1467
976
2915
210
Inboard


2165
3451
645
589
2196
3369
1520
967
2862
206
Outboard

The Inboard and Outboard alternatives would be considerably more effective than other alternatives in carrying traffic from each of the tunnels to the periphery of Manhattan. While the number of vehicles going directly to the highway would be moderate in number, it is an increase of 100 percent as compared with Maintenance. The Inboard and Outboard alternatives have direct ramp connections to highway mainlines. As such, vehicles traveling between either the Inboard or Outboard highway and the tunnels would not use local streets.

Truck Traffic

The diversion of truck traffic to a new highway facility and away from local streets was one of the planning objectives of the Project. One means of assessing the extent that the alternatives would achieve this potential is estimating total daily truck vehicle miles of travel on West Street and other arterial streets. These estimates were developed for each alternative in the study area, and for individual Community Planning Districts. It should be noted that for purposes of this discussion, trucks have been defined as vehicles with six or more tires. Four-wheel trucks, such as light delivery and panel trucks, have been included with autos and taxis because their environmental and traffic characteristics are more like autos. These estimates of truck VMT are shown in Table 42 and Illustrations 84 and 85.

Illustration 83 Morning Peak Hour Tunnel Exit Volumes in 1995

▨ Volumes to the West Side Highway

▨ Volumes to the Local Streets

North

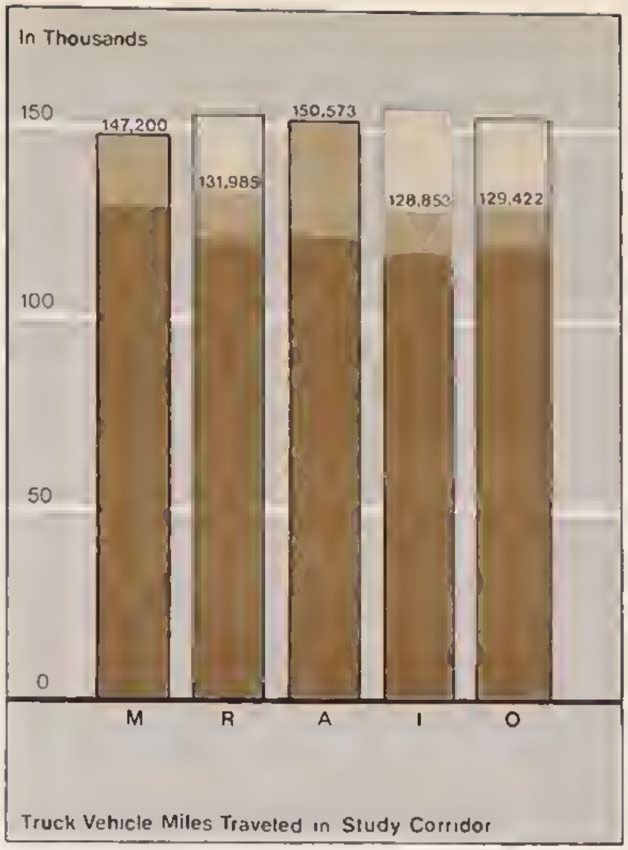


Illustration 84 Daily Truck Vehicle Miles of Travel in 1995(a)

▨ Vehicles Miles of Travel on the West Side Highway

▨ Vehicle Miles of Travel on West Street

▨ Vehicle Miles of Travel on Local Streets

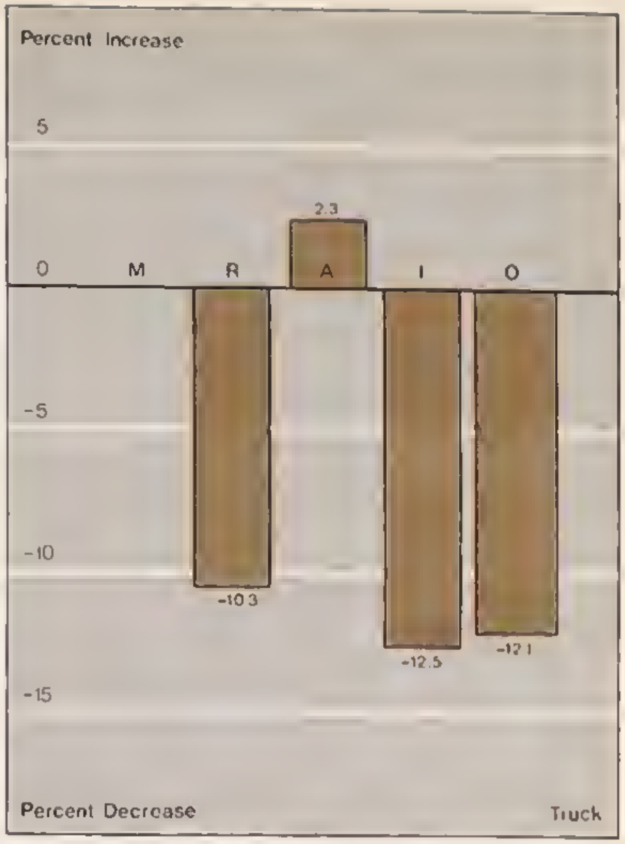


Illustration 85 Percent Difference in Truck Vehicle Miles of Travel on Local Streets Between Maintenance and Other Alternatives in 1995 (a)

(a) M Maintenance Alternative
R: Reconstruction Alternative
A: Arterial Alternative
I, Inboard Alternative
O. Outboard Alternative

Table 42 1995 24 Hour Truck Vehicle Miles of Travel (VMT) in the Impact Area by Alternative(a)

	Maintenance	Reconstruction	Arterial	Inboard	Outboard
Arterials(b)					
Amount	128,095	119,276	120,925	117,036	118,578
Percent of Total	87	79	80	76	78
Arterials plus West Street					
Amount	147,200	131,985	150,573(d)	128,853	129,422
Percent of Total	100	87	100	83	85
Total(c)	**147,200**	**150,938**	**150,573**	**154,720**	**152,560**

(a) See Appendix for map of Impact Area TVMT based on traffic assignments developed from Minimum (B) Land Use Forecasts.

(b) Arterials include all streets in Impact Area except West Street.

(c) Total includes arterials, West Street, and the West Side Highway.

(d) Mainline and service road in the Arterial Alternative are considered as West Street.

No truck traffic would be permitted on the Maintenance alternative, and all truck travel in the study area would be on West Street and the other arterials. The Reconstruction alternative would allow trucks on the mainline from the Brooklyn-Battery Tunnel to 57th Street. The effect would be to reduce truck VMT on West Street and other arterials in the study area by about 10 percent. The Arterial alternative does not incorporate a limited access, grade separated highway, and all truck travel in the study area would occur on West Street and other arterial streets. The Inboard and Outboard alternatives would permit trucks on the new highway to 30th Street. Trucks would have to leave the highway at 30th Street, and use West Street or other arterials to travel further north. The daily vehicle miles of travel on West Street and other arterials in the study area are about 2 percent lower than those reported for the Reconstruction alternative.

The differences among the alternatives discussed above are not homogeneously distributed throughout the study area For this reason, the same measures were applied to each of the local communities in the Corridor. For Community Planning District One (Table 43, and Illustrations 86 and 87) the Inboard and Outboard alternatives would be about 6 percent more effective than the Reconstruction alternative in diverting truck vehicle miles of travel from West Street and other arterials. A comparison between Reconstruction, and Inboard and Outboard alternatives in the Community Planning District Two area (Table 44, and Illustrations 86 and 87) indicates that diversion with these three alternatives would be approximately the same. The Reconstruction alternative would attract more trucks north of Canal Street than it does to the south. Compared to the Maintenance alternative, there would be 18 percent less truck VMT on West Street and other arterials in the Community Planning District Two area, but only 8 percent less in the Community Planning District One. In Community Planning District Four (Table 45, and Illustrations 86 and 87), the Reconstruction alternative would reduce truck VMT on West Street and the arterials more than the Inboard or Outboard, because trucks would be able to use the rebuilt facility to 57th Street.

Table 43 1995 24 Hour Truck Vehicle Miles of Travel (VMT) in Community Planning District One(a)

	Maintenance	Reconstruction	Arterial	Inboard	Outboard
Arterials(b)					
Amount	28,162	26,356	25,688	26,184	25,878
Percent of Total	84	79	76	72	72
Arterials plus West Street					
Amount	33,423	30,812	33,591(d)	29,007	28,265
Percent of Total	100	92	100	80	78
Total(c)	33,423	33,637	33,591	36,262	36,117

(a) See Appendix for map of area used to approximate Planning District One; TVMT based on traffic assignments developed from Minimum (8) Land Use Forecasts.

(b) Arterials include all streets but West Street.

(c) Total includes arterials, West Street, and the West Side Highway in Planning District One.

(d) Mainline and service road in the Arterial Alternative are considered as West Street.

Table 44 1995 24 Hour Truck Vehicle Miles of Travel (VMT) in Community Planning District Two(a)

	Maintenance	Reconstruction	Arterial	Inboard	Outboard
Arterials(b)					
Amount	38,510	36,077	37,341	34,256	35,612
Percent of Total	77	72	72	67	70
Arterials plus West Street					
Amount	50,122	41,488	51,531(d)	37,905	39,681
Percent of Total	100	82	100	74	78
Total(c)	50,122	50,498	51,531	51,396	50,948

(a) See Appendix for map of area used to approximate Planning District Two; TVMT based on traffic assignments developed from Minimum (8) Land Use Forecasts.

(b) Arterials include all streets but West Street.

(c) Total includes arterials, West Street, and the West Side Highway in Planning District Two.

(d) Mainline and service road in the Arterial Alternative are considered as West Street.

Table 45 1995 24 Hour Truck Vehicle Miles of Travel (VMT) in Community Planning District Four(a)

	Maintenance	Reconstruction	Arterial	Inboard	Outboard
Arterials(b)					
Amount	38,594	34,671	35,878	34,214	34,778
Percent of Total	95	76	84	77	81
Arterials plus West Street					
Amount	40,517	36,997	42,869(d)	38,904	38,422
Percent of Total	100	81	100	87	89
Total(c)	40,517	45,822	42,869	44,759	43,187

(a) See Appendix for map of area used to approximate Planning District Four; TVMT based on traffic assignments developed from Minimum (8) Land Use Forecasts.

(b) Arterials include all streets but West Street.

(c) Total includes arterials, West Street, and the West Side Highway in Planning District Four.

(d) Mainline and service road in the Arterial Alternative are considered as West Street.

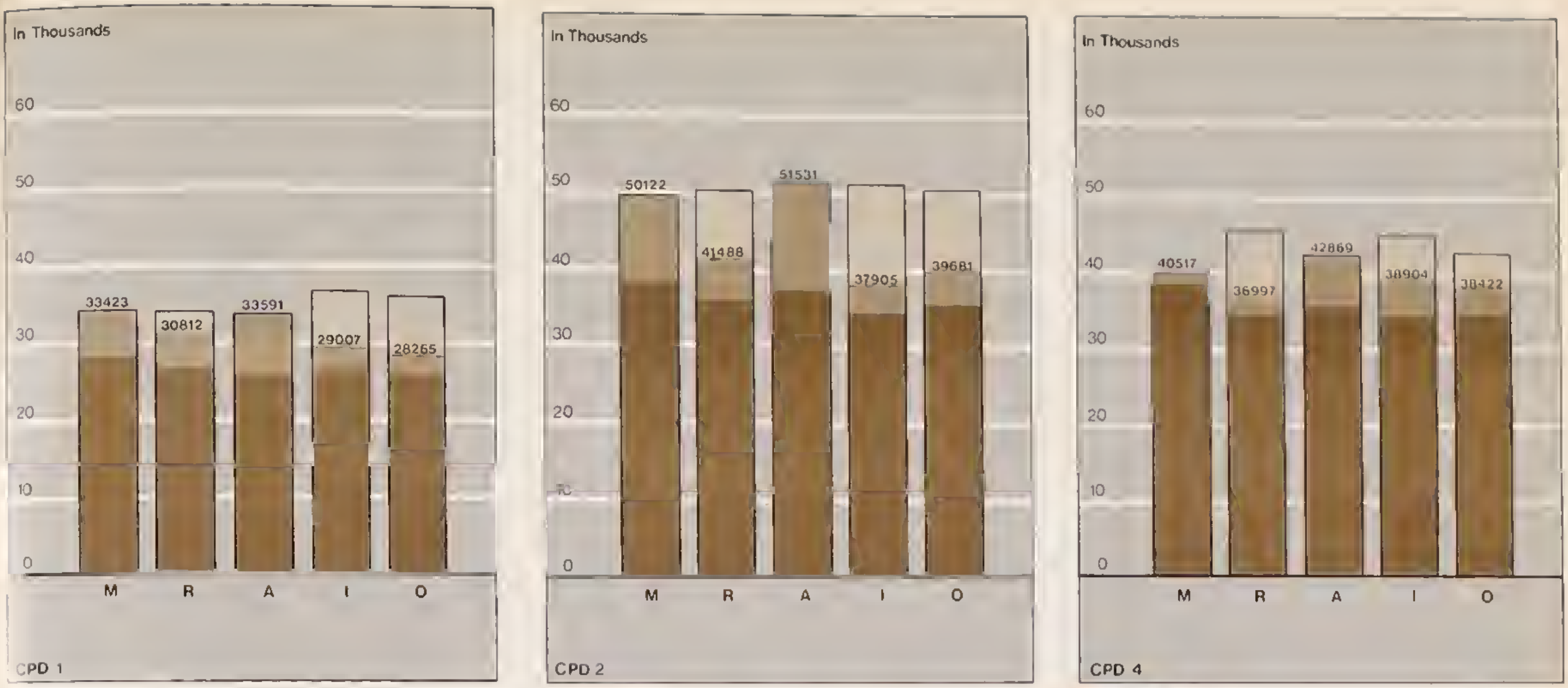


Illustration 86 Daily Truck Vehicle Miles of Travel in 1995

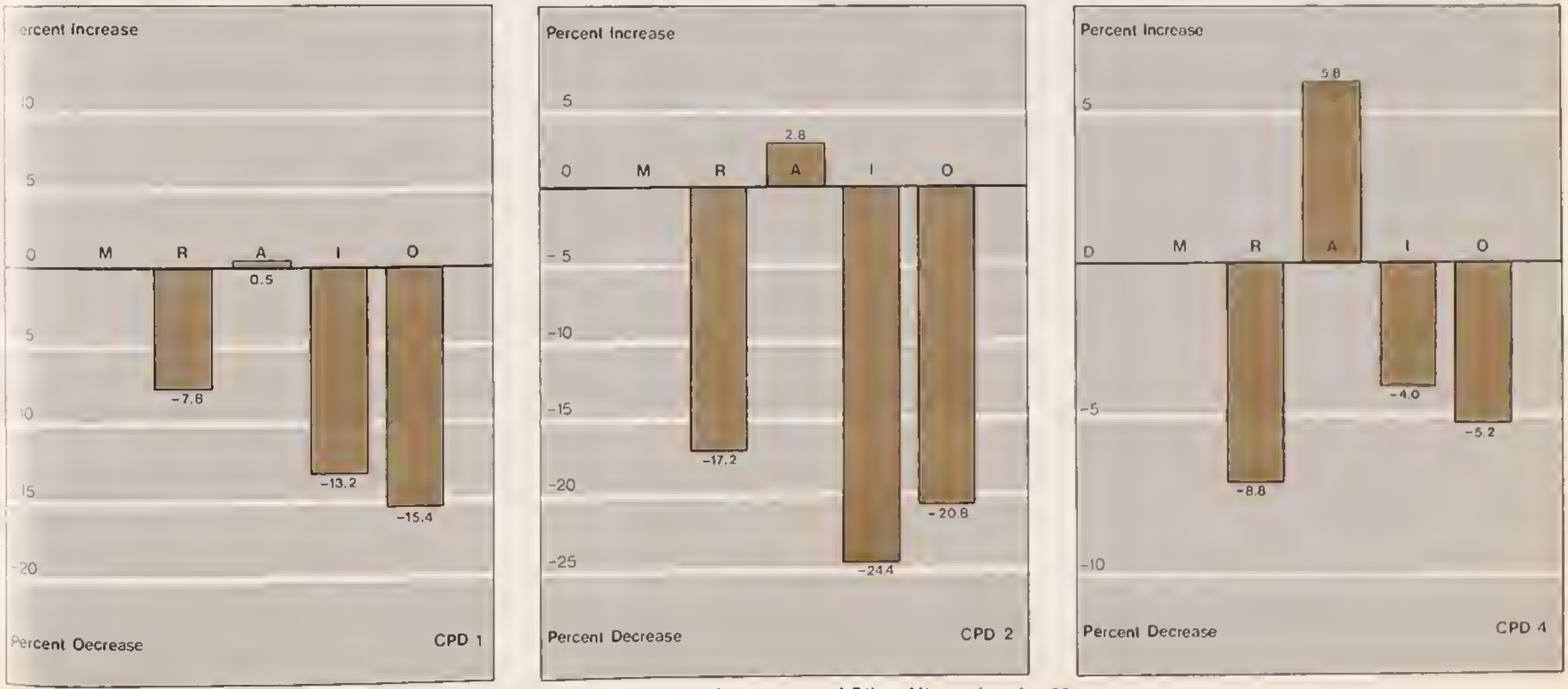


Illustration 87 Percent Difference in Truck Vehicle Miles Traveled Between Maintenance and Other Alternatives in 1995

Parking

A proposal to develop parking strategies as part of the overall program package development was an original policy of the Steering Committee. The objective was to reduce the number of parking spaces in the Manhattan Central Business District.

Subsequent to this declaration, the City Planning Department developed a strategy of limiting parking spaces in the CBD through changes in the zoning regulations. These regulations would restrict the parking space that could be built in conjunction with residential developments, and would require permits for those built as part of commercial developments or solely as parking facilities. The policy was to limit the spaces available to commuters for all-day parking. The City determined that many spaces constructed as part of residential developments were not being used by residents, but were being rented out as commercial spaces to commuters in the area.

Estimates of parking spaces available in 1995 were prepared, based on the amount of residential development and other land uses, rather than being based on the transportation improvements in the alternative program packages. The estimated increase of 14,000 off-street parking spaces between 1972 and 1995 largely resulted from specifically planned projects in the Corridor, as shown in Illustration 90. These include Battery Park City, the proposed Convention Center and the Passenger Ship Terminal, which together may add about 10,000 parking spaces in the CBD, an increase of about 10 percent over 1972.

Illustration 88 **Estimated Parking Spaces in the Manhattan CBD by Quarter Square Mile**

🟫 **1972 to 1995 Increase in Parking Spaces**

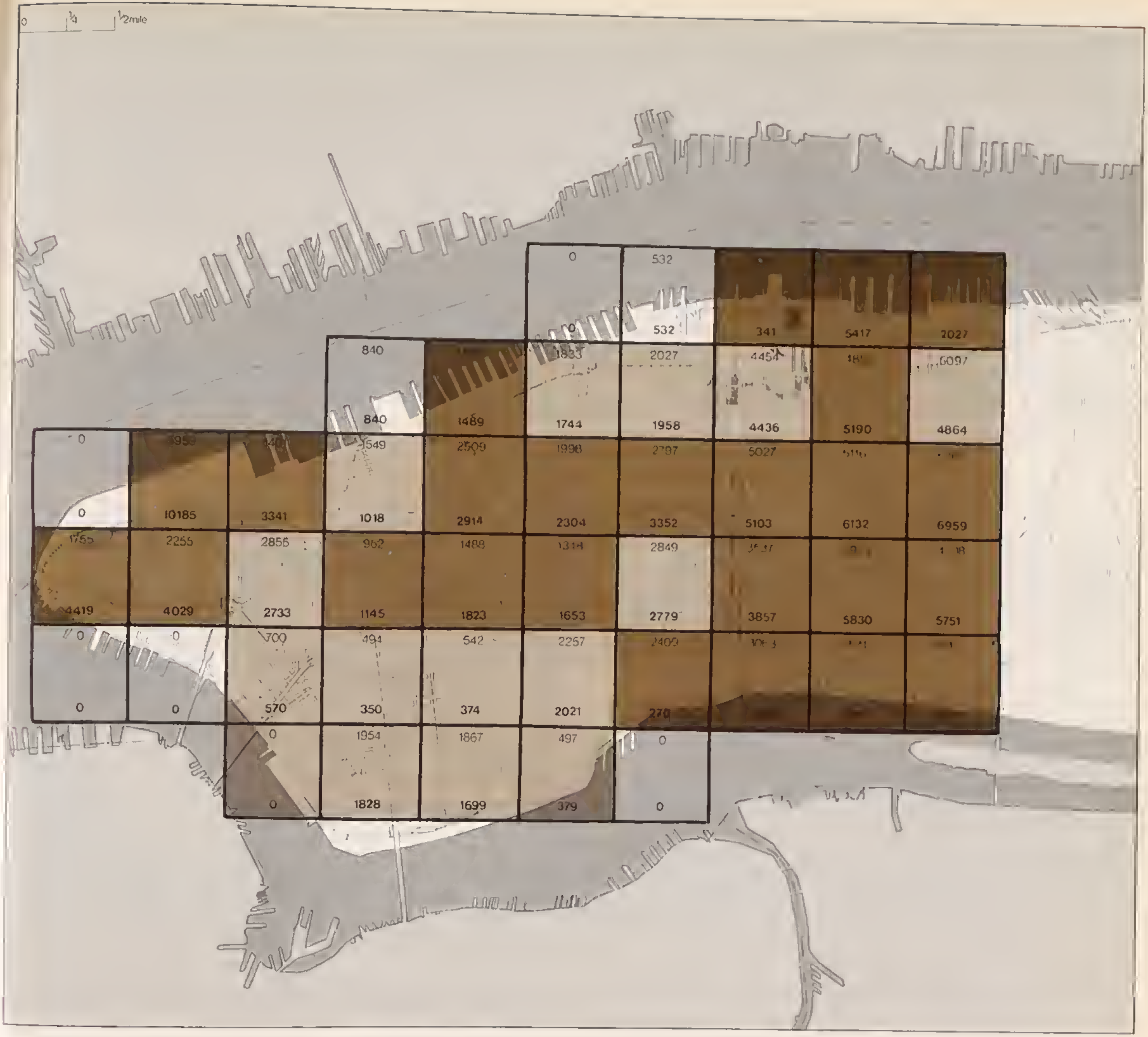
▒ **1972 to 1995 Decrease in Parking Spaces**

☐ **No Change in Parking Spaces**

000 **1972 Parking Spaces**

000 **1995 Parking Spaces**

North


0
¼
½mile
0
532
0
532
341
5417
2027
840
1833
2027
4454
6097
840
1489
1744
1958
4436
5190
4864
0
3959
1549
2509
1998
2797
5027
0
10185
3341
1018
2914
2304
3352
5103
6132
6959
1755
2255
2856
962
1488
1318
2849
4419
4029
2733
1145
1823
1653
2779
3857
5830
5751
0
0
700
494
542
2257
2409
0
0
570
350
374
2021
270
0
1954
1867
497
0
0
1828
1699
379
0

Public Transit

As directed by the Steering Committee, an investigation was conducted to determine the potential of public transportation in the study area. This work led to the incorporation of a transitway facility into the Inboard, Outboard and Arterial alternatives. The transitway was developed to accommodate either express buses or rail transit.

The differences between the two systems, which were described in Section 3, are presented in detail in the **Manhattan West Side Corridor Transit Study Report**. In terms of general service characteristics, rail transit would be more limited to intra-Manhattan and intra-New York City service than the more flexible express bus system. This is shown in the 24-hour, two-way passenger volumes by origin for the rail and bus systems in Illustrations 89 and 90.

One effect of the proposed West Side transit systems would be to divert some automobile drivers and passengers from private vehicles to public transportation. It is estimated that this diversion would range between 14,000 and 24,000 trips per day in 1995, depending upon whether a rail transit or an express bus system were chosen. In general, it is expected that the bus system would divert more riders from automobiles than would the rail system, due to its service characteristics.

The double track rail transitway would provide two express services: one from 178th Street (George Washington Bridge), stopping only at 96th Street, and the second from Grand Concourse and 149th Street, stopping at 145th Street and St. Nicholas Avenue, and at 96th Street. South of 60th Street, the stops would be more local, similar to existing subway systems. The rail transitway would provide a high speed bypass around the most crowed sections of the West Side IRT and IND lines. Riders originating outside of New York City would transfer to the new West Side rail line only at George Washington Bridge—about 57,000 two way daily trips, and at the 149th Street Transportation Center—86,000 daily trips to and from commuter rail lines. About 1,700 daily trips to and from Westchester County would use feeder bus service to various stations on or connecting to the new West Side rail transitway.

The bus transitway would provide a similar type of express service between the George Washington Bridge and each of the CBD collection-distribution routes—57th Street, 49th-50th Street, 42nd Street, 34th Street, 23rd Street, 14th Street and Lower Manhattan, including the World Trade Center-Battery Park City and Manhattan Landing.

The express bus alternative would be more regional in character, and would provide access to suburban points in New York and New Jersey. Of the 118,000 daily two-way bus trips crossing 60th Street, 44,000 would be to and from residences in the City of New York, and the balance, or 63 percent would be from the suburban counties. In addition, the busway would provide service to 19,000 daily riders to and from Brooklyn and Staten Island.

The express bus system was specifically planned to provide good access for surburban areas in New Jersey and New York which are generally not well served by rail systems. These areas are characterized by a relatively high percentage of auto use by travelers to Manhattan The express bus system would provide these areas with high speed direct access to Manhattan with a maximum of one transfer. For riders boarding express buses on the higher density routes, a majority should be able to make their trips without any transfers. Traffic analysis indicates that 40 to 50 percent of the 164,000 busway riders would not require transfers. No rider would transfer more than once on the express bus system.

Illustration 89 Projected Daily Express Bus Passenger Volumes in 1995

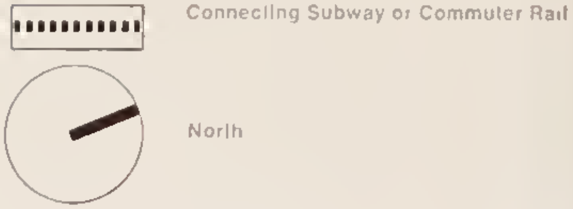
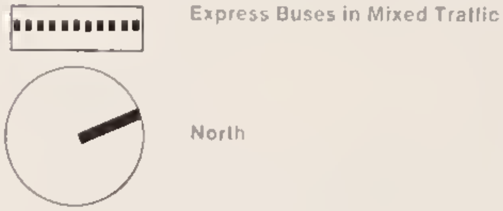
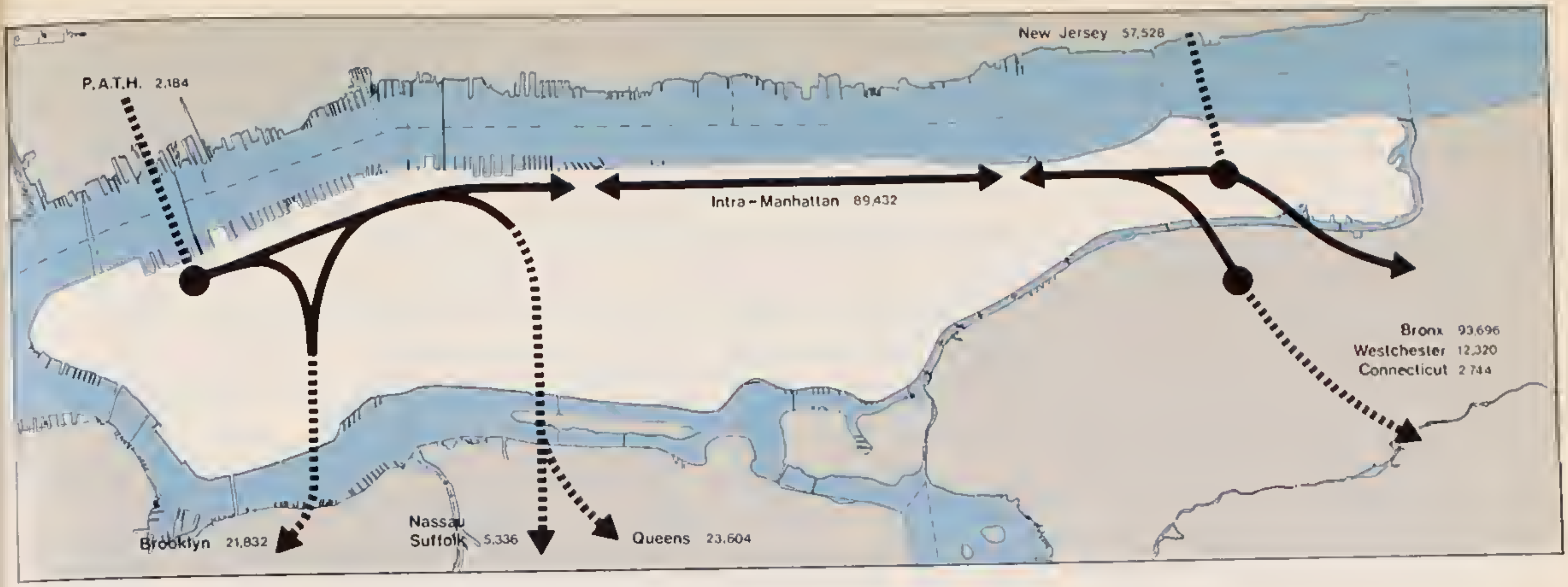
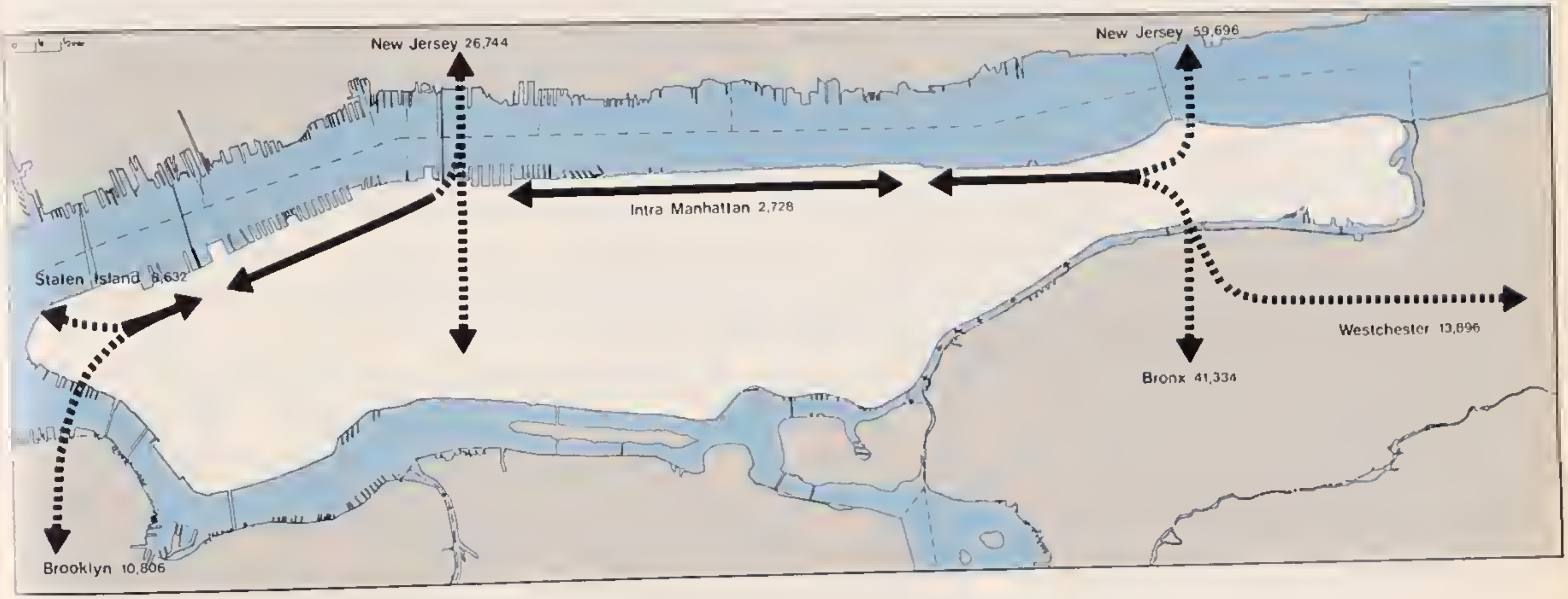


Illustration 90 Projected Daily Rail Passenger Volumes in 1995




P.A.T.H. 2,184
New Jersey 57,528
Intra-Manhattan 89,432
Bronx 93,696
Westchester 12,320
Connecticut 2,744
Brooklyn 21,832
Nassau
Suffolk 5,336
Queens 23,604


New Jersey 26,744
New Jersey 59,696
Intra Manhattan 2,728
Staten Island 8,632
Westchester 13,896
Bronx 41,334
Brooklyn 10,806

Impacts on Energy Consumption

The problems of energy supply and consumption have become increasingly severe in recent years, but have only recently emerged as a serious public issue directly affecting the lives of most Americans. The energy issue is one complicated by many competing interests including: national and international politics; environmental concerns; City, State, and Federal regulations and taxing policy; private sector corporate policies and profits, short and long range technological capabilities; and the comfort, convenience and finances of individual consumers.

Transportation and Energy

Nationally, transportation is second only to manufacturing in energy consumption, representing 31 percent of the nation's total energy use. Manufacturing leads in energy consumption with 35 percent of the total, and residential, commercial and public facilities follow with 18 percent and 14 percent, respectively.

In the New York Region, and in New York City in particular, a very different pattern emerges. A recent joint study by the Regional Plan Association and Resources for the Future reports that the New York Region, with almost 10 percent of the nation's population, uses only 6.5 percent per capita of the total energy consumed in the United States, based on 1970 data.[58]

Per capita consumption of energy for industry in the Region is only 18 percent of the national average, and within New York City this drops to 9 percent. The reason for the relatively minor role of industry in energy consumption in New York appears to be higher energy costs, encouraging energy-intensive industries to locate elsewhere.

Energy consumption for transportation is influenced by two related factors—population density and the primary modes of transportation. Per capita consumption of energy for transportation in the Region is 25 percent less than the national average, and New York City itself uses less than 50 percent of the national average due primarily to the Region's density of development, resulting in high utilization of energy-efficient public transportation. High population and employment densities also result in fewer and shorter trips by energy-consuming modes.

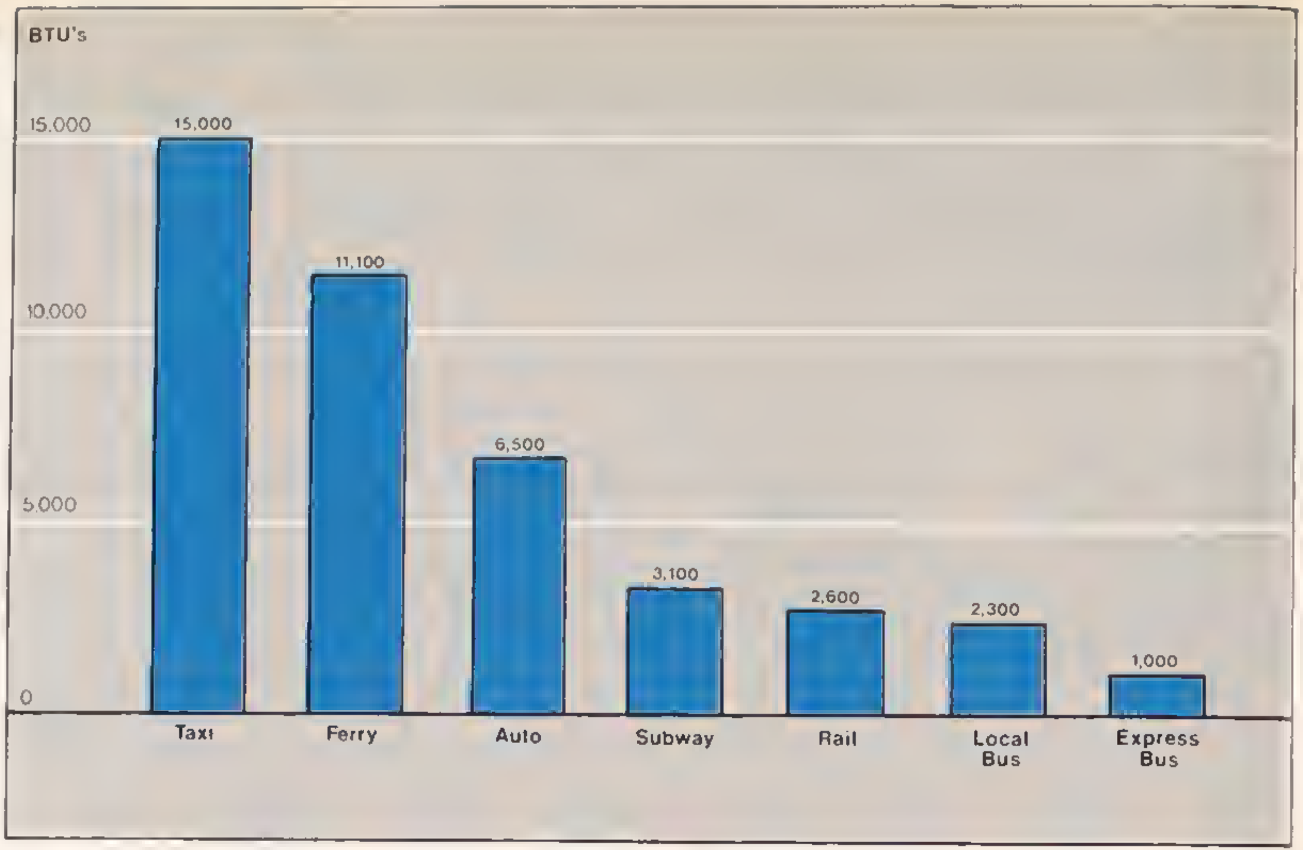


Illustration 91 **British Thermal Units (BTU) per Passenger Mile Traveled (PMT)**

Energy Efficiency and Transportation Modes

In order to determine the impact of a particular mode of transportation on the energy problem, it is necessary to determine the relative energy consumption of each transportation mode within the Region. Energy consumption is here expressed in British Thermal Units per Passenger Mile Traveled (BTU/PMT), or, the number of BTU's consumed to move one passenger one mile. This consumption measure is dependent on two variables—passengers per vehicle and the BTU equivalent of miles per gallon or miles per kilowatt hour consumed.

Within the New York Region, the express bus is the most energy-efficient mode, consuming only 1,000 BTU per passenger mile of travel. The local bus, consuming 2,300 BTU/PMT, is a close second, with the difference primarily due to the higher occupancy factor of the express bus and less energy loss from stop and start operation. Combining low energy consumption and routing flexibility, the express bus offers a major opportunity for energy conservation in transportation.

The New York commuter railroad and subway systems are next in efficiency, consuming 2,600 and 3,100 BTU per passenger mile respectively. The energy efficiency of rail systems depends on such factors as car weight, acceleration rates, braking systems and frequency of station stops. The subway is less energy-efficient than the railroad, primarily due to the energy lost in frequent braking and acceleration due to the short distances between stations necessary in a high-density area. The energy-efficiency of both railroad and subway has also been adversely affected by declining ridership and the increased energy demand caused by widespread use of air conditioning.

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[58] **Regional Energy Consumption**, Regional Plan Association, Inc., and Resources for the Future, Inc., 1971

The automobile, consuming 6,500 BTU/PMT, has less than half the energy efficiency of the subway. In recent years, the auto has experienced a decline in efficiency primarily due to a decrease in gasoline mileage for American-made cars. As much as half of the energy consumed by the automobile is due to power accessories such as air conditioning, power steering and brakes, automatic transmissions and inefficiences caused by emission control devices.

The taxi, two and half times less efficient than the average private automobile, consumes 15,000 BTU/PMT. This considerable inefficiency is primarily due to poor vehicle maintenance, a low passenger occupancy rate and stop and start driving characteristics.

In summary, the express bus is the most energy-efficient mode of transportation, consuming 1,000 BTU to move one passenger one mile. The local bus follows in efficiency, requiring twice the energy of the express bus. The railroad requires two and half times the energy, the subway over three times, the auto six times, and finally the taxi, which requires 15 times the energy of the express bus per passenger mile traveled.

Probable Impacts of Alternatives

To appreciate the impact of West Side Highway Project alternatives on energy consumption, it is necessary to view the Project in relation to Manhattan and the New York Region. In 1970, auto travel constituted 83 percent of the person-miles traveled on ground transportation in the Region, while consuming 90 percent of the total energy used. The subway accounted for 7.5 percent of the person-miles traveled on the ground, and consumed 3.9 percent of the total energy used for ground transportation.

However, in terms of 1970 daily trips into Manhattan from origins within the Region, the gap between auto and subway passenger miles and energy consumption is closed substantially. Auto travel currently constitutes approximately 6.7 million daily one-way passenger miles traveled into Manhattan, compared with 15.0 million on the subway. Translated into total energy, auto travel consumes approximately 43 billion BTU against 47 billion BTU for subway travel. Thus, the subway plays a substantially greater role in Manhattan bound trips in comparison to the Region as a whole and is relatively equal to the auto in energy consumption for this purpose. This is important in assessing the role of the auto in Manhattan-bound trips. More importantly, it is relevant to note that many auto trips to Manhattan are essentially not susceptible to diversion to other modes.

The effect on energy consumption by limiting auto travel to Manhattan can be illustrated by a radical and obviously hypothetical example. Currently, auto travel to Manhattan from origins outside the Island consumes, on a one way basis, approximately 43 billion BTU or 86 billion BTU per day for two-way trips. This amount represents three percent of all energy consumed in the New York Region for daily passenger travel. If all of these trips could be totally diverted to mass transit, the daily regional energy consumption for passenger travel would only be reduced by from 1.5 to 2.5 percent, depending on transit mode or combination of modes utilized for this diversion. Improving auto efficiency from the current average of 12.8 miles per gallon to 13.3 miles per gallon could achieve the same regional energy savings.

To evaluate the differences between Project alternatives in terms of relative energy consumption, an estimate of the total daily energy consumed within Manhattan for autos and trucks in 1995 was developed for each alternative. The energy calculations were derived from West Side Highway Project 1995 traffic assignments to the Manhattan highway network, incorporating traffic forecasts for each alternative and assuming 1970 average fuel consumption rates for autos and trucks of 12.8 miles per gallon and 5.0 miles per gallon respectively. The Inboard and Outboard alternatives include calculations of energy consumption of ventilation systems for covered sections of the proposed highway.

As is apparent from the accompanying table, the maximum differences in energy consumption between alternatives is less than one percent.

Table 46
Estimated Energy Consumption for Vehicle Travel Within Manhattan in 1995 (In millions)

	Annual Vehicle Miles Traveled	BTU's Consumed In 1970
Maintenance	2,200	23,688,000
Reconstruction	2,224	23,745,000
Arterial	2,194	23,452,000
Inboard	2,195	23,558,000
Outboard	2,208	23,728,000

Transit Alternatives

The West Side Highway Project has developed two transit options as integral parts of the Arterial, Inboard and Outboard alternatives, described in detail in Section 3. The exclusive busway would extend 11.2 miles from the Battery to the George Washington Bridge, carrying 163,800 daily passenger trips, and diverting 15 percent or 24,400 trips which would otherwise be made by auto. The rail transit alternative would extend 18.0 miles from the Battery into the Bronx, carrying 297,000 daily passenger trips and diverting 5.7 percent, or 18,000, trips which would otherwise be made by auto.

The busway option would consume 1,113 billion BTU annually, or one percent of the 1970 regional energy consumption for passenger travel. However, the 15 percent diversion of riders from autos would save 913 billion BTU annually, almost equal to the total energy consumption of the busway option. The rail transit option would consume 1,227 billion BTU annually, equal to approximately one percent of the 1970 regional energy consumption for all passenger travel. The 5.7 percent diversion of trips from autos would save 256 billion BTU annually, or 21 percent of the total energy consumption for the rail option.

Air Quality

This discussion describes the five specific studies performed to determine the probable impacts of Project alternatives upon air quality in the New York Region and on the West Side of Manhattan. The studies included an analysis of the effects of the alternatives on air quality in: (1) the New York Region; (2) the areas immediately adjacent to the Highway (primary impact area); (3) the West Side of Manhattan in those streets on which traffic would change as a result of the alternatives (secondary impact area); (4) the streets affected by Lincoln and Holland Tunnel traffic (tunnel areas); and, (5) the areas adjacent to the proposed ventilation buildings (vent buildings).

Each of these studies represents a separate analysis designed for the specific application involved. Every effort was made, however, to use a common set of data for all of the studies. In some cases, it was necessary to seek other sources for specific items of data that were not available in the common data base. For example, the vehicle miles traveled in Manhattan are available from the Project traffic studies, while the vehicle miles traveled outside of Manhattan must be derived directly from Tri-State data. In every instance of such alternative data use, the sensitivity of the results of the study to possible differences among alternative items of data was determined to be negligible. The results presented here, therefore, are as accurate as available data and methodology allow, and may be considered to be a reasonable representation of the potential impacts on air quality. Also, where it was necessary to make assumptions, preference was given to the assumption that would lead to an over-estimation of the impact rather than an average estimation. The impacts as presented here, therefore, are maximum possible impacts. This philosophy is necessary to conform with current Federal laws and Federal Environmental Protection Agency (EPA) administrative recommendations.

Methodology

These studies were performed by the Project staff utilizing the best available data and methodology. In some instances, new and improved methodology was developed specifically for this Project. In addition, throughout the studies, close contact was maintained between the staff and the City, State, and Federal air quality agencies—the New York City Environmental Protection Administration (City EPA), the New York State Department of Environmental Conservation and the Federal EPA.

Regional Study

A major transportation facility may have an effect on the air quality of the region where it is located. This effect may occur because a new facility may cause a significant change in the routing of traffic, in the average speed at which traffic moves, or in the amount of traffic using the regional roads.

A reasonable measure of impacts may be made by comparing the vehicle miles traveled throughout the region among the alternative proposals. This conclusion was reached after consultation with local and Federal air quality officials. On May 2, 1973, at a meeting of Project staff with City EPA, the New York City Air Resources Commissioner stated that regional air quality would not be affected by the Project alternatives unless the vehicle miles traveled on a new highway facility would exceed one percent of the total regional vehicle miles traveled.[59] In a meeting with Federal EPA on May 21, 1973, the Chief of the Air Programs Branch for Region II voiced his agreement with the Commissioner's Statement.[60]

Thus, for purposes of air quality analysis, the regional traffic relationships among the alternatives may be drawn in terms of vehicle miles traveled. This measure of traffic must then be translated into specific pollutants in order to determine how the Project relates to the Air Quality Implementation Plan. As described in Section 2 of this Statement, there are five vehicular source pollutants of prime concern—carbon monoxide, hydrocarbons, nitrogen oxides, particulates, and secondary pollutants such as oxidants. According to the Air Quality Implementation Plan, mobile air pollutant sources in the metropolitan area account for 95 percent of carbon monoxide emissions, 40 percent of nitrogen oxide emissions, 65 percent of hydrocarbon emissions, and only 15 percent of suspended particulate emissions. Secondary pollutants such as oxidants are controlled by controlling emissions of hydrocarbons. The plan deals, therefore, only with carbon monoxide, hydrocarbons, and nitrogen oxides. The plan further states that:

Violations of carbon monoxide air quality standards must be analyzed on a site-by-site basis. Emissions on a general area basis cannot necessarily be related to the magnitude by which the standards will be exceeded at specific locations within the area.[61]

Thus, carbon monoxide should be examined on a local basis and should not be included in a regional analysis. This pollutant has been extensively studied in the primary, secondary, tunnel area, and vent building analyses. Hydrocarbons and nitrogen oxides, however, should be studied only on a regional rather than on a site-by-site basis. These compounds have their major role as pollutants in the formation of photochemical smog. The major component of smog—oxidants, are produced as the result of the reaction of hydrocarbons and nitrogen oxides in the presence of sunlight. This reaction characteristically requires several hours. The prevailing winds carry the pollutants several hours downwind of the motor vehicle emission source before the photochemical reaction actually produces smog. At the May 1973 meeting with Federal EPA, the Air Programs Branch Chief made three significant suggestions with regard to a regional air quality analysis:

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[59] "Meeting with New York City Department of Air Resources," Project Memorandum, May 4, 1973.

[60] "Meeting with Conrad Simon of the Federal Environmental Protection Agency," Project Memorandum, May 22, 1973.

[61] **New York City Metropolitan Area Air Quality Implementation Plan,** New York State Department of Environmental Conservation, April 1973, pages 1-9.

- The annual tonnage of total hydrocarbons and nitrogen oxides produced in Manhattan for the no-build options should be compared with the figures for the build options. The difference between these numbers should then be compared with the metropolitan area. If this ratio is a very small percentage, hydrocarbons and NO_x may be considered to be no problem and the EPA would consider that the Project has satisfied the National Ambient Air Quality Standards for these two pollutants.

- Local prediction of vehicular-generated hydrocarbons and nitrogen oxides concentrations are unnecessary.

- Agreement has been reached between the Federal EPA and New York State that an emission roll-back of 66-70 percent would be necessary to satisfy Federal standards on hydrocarbons and nitrogen oxides by 1976.

In addition, he suggested that the appropriate region to be studied is the Metropolitan New York Air Basin. The regional air quality study was carried forward following these various recommendations from the local and Federal air quality authorities.

Study Area The Metropolitan New York Air Basin includes 19 counties in the greater New York metropolitan area, as shown in Illustration 92.

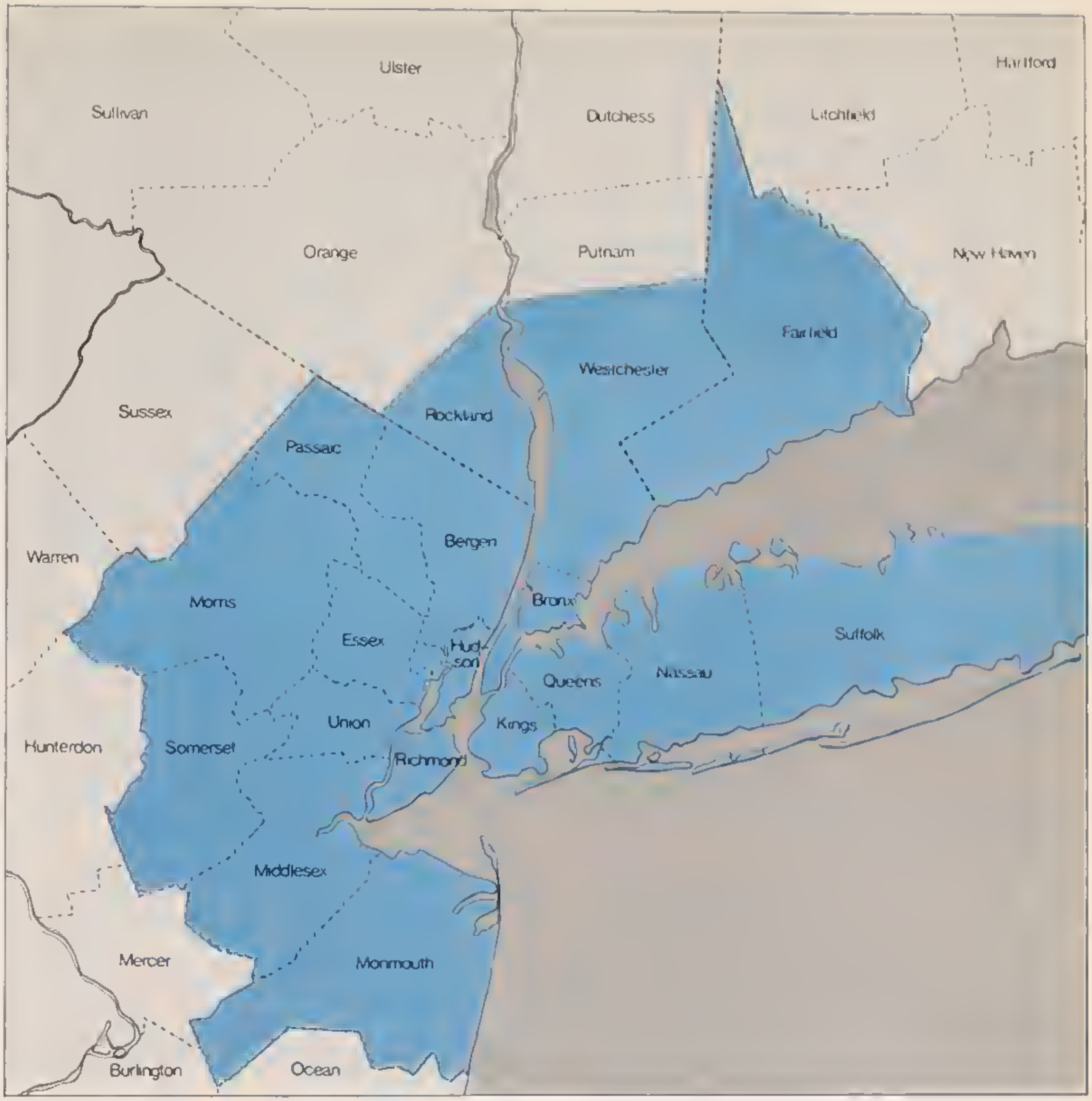


Illustration 92 The Metropolitan New York Air Basin

▨ Counties Included in Project Air Quality Study

North

For purposes of comparison of West Side Highway emissions with regional emissions, traffic in the Project impact area was used as the variable emission generator. This impact area is defined as the area bounded on the west by the United States Pierhead Line in the Hudson River, on the north by 60th Street, on the east by Fifth Avenue (between 60th and 10th Streets), Second Avenue (between 10th and Hudson Streets), the Bowery (between Hudson and Canal Streets), and by the East River (below Canal Street), and on the south by the tip of Manhattan.

Data The regional analysis involved a three step process First, the vehicle miles traveled were determined for the Region and for the Project impact area. Second, the vehicle miles traveled were converted into hydrocarbon and nitrogen dioxide emissions. Third, the emissions for the impact area were compared with those for the Region.

Data on vehicle miles traveled were compiled from two sources. For trips in Manhattan, the Project traffic study computer output was used. For trips outside of Manhattan, where vehicle miles traveled were not calculated by the Project traffic study, data was supplied by the Tri-State Regional Planning Commission (Tri-State). The percentage of trucks contributing to the vehicle miles traveled was derived from three sources. For Manhattan, Project traffic studies were used. For the other boroughs and the remainder of the Region, truck percentages were derived from the Air Quality Implementation Plan and from Tri-State data. Emissions were calculated from official Federal EPA figures.

Primary Impact Area
The primary impact area is defined for air quality purposes as the corridor of land whose air quality would be affected directly by emissions from the vehicles travelling on the proposed transportation facilities. The study performed in this impact area was concerned with the prediction of future carbon monoxide concentrations at four specific locations that were expected to experience typical concentrations adjacent to any new highway facility.

The methodology involved measuring present day carbon monoxide concentrations and meteorology adjacent to the existing Highway, using the measured concentrations to calibrate a mathematical model which predicts future concentrations at the same locations, and operating the model to make such predictions. The predicted concentrations were then compared with National Ambient Air Quality Standards, and the various alternatives compared.

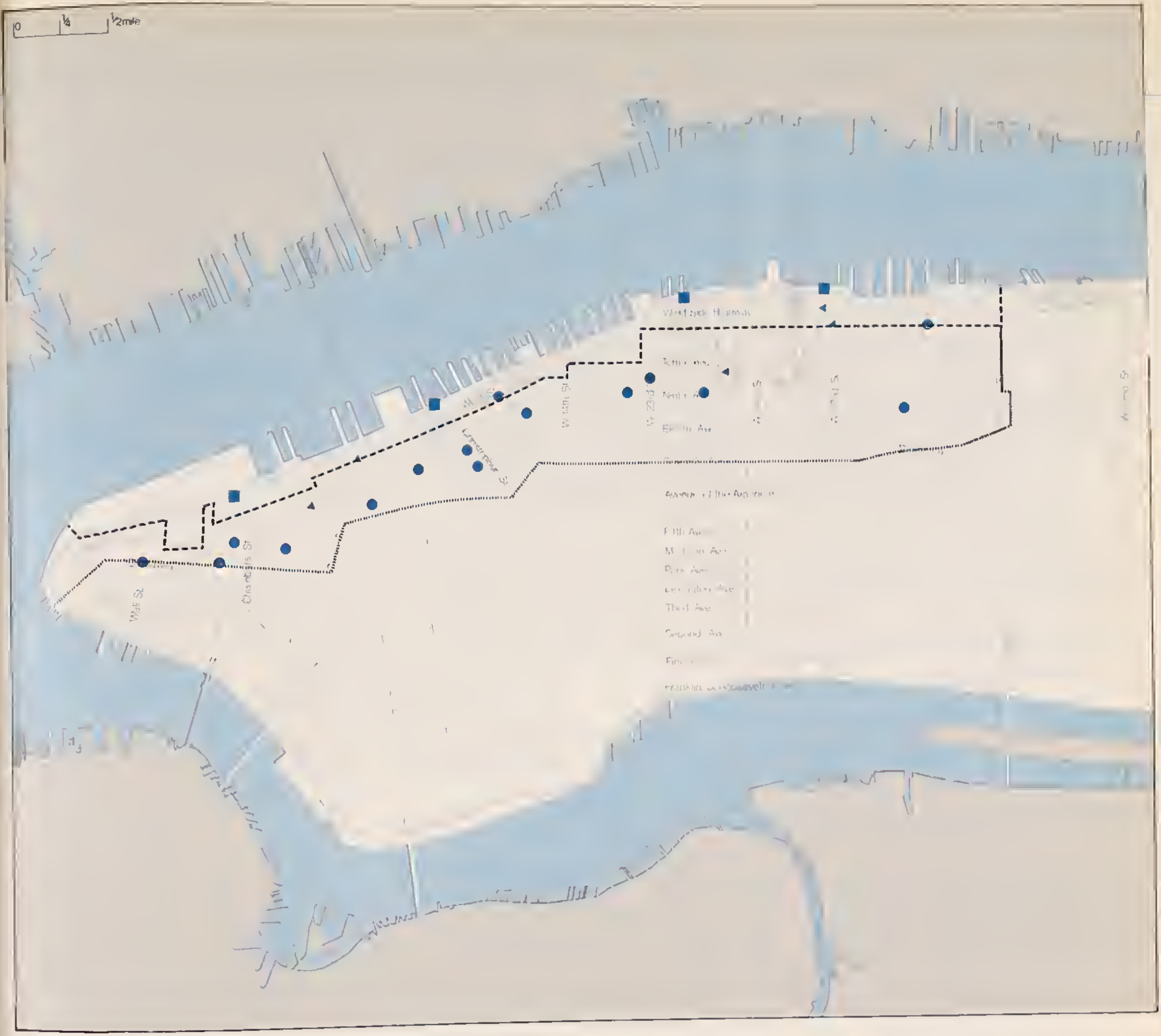
Study Area The primary impact area was selected as the area bounded by the pierhead line on the west, 42nd Street on the north, the building line on West Street-Twelfth Avenue on the east, and Battery Park on the south. Carbon monoxide, the pollutant of prime interest, disperses rapidly in the atmosphere, and at a distance of 50 to 100 feet from the pollution source the effect of the traffic on a highway or collector-distributor streets would be so small as to be unmeasurable, compared with existing levels of carbon monoxide from other sources. Thus, it was not necessary to determine the direct effects of new highway facilities outside of the primary impact area, as shown in Illustration 93.

The four sites chosen for measurements, calibration, and prediction are West and Murray Streets, West and Christopher Streets, Eleventh Avenue and 26th Street, and Twelfth Avenue and 41st Street. These sites provide, under various Project alternatives, prototypical elevated sections, sections including ramps, depressed uncovered and covered sections, and at-grade sections. Thus, the pollution levels to be derived from this analysis at these locations may be considered to be representative of the levels to be found elsewhere at similar types of sections. In particular, at any highway cross-section where the traffic, highway configuration and collector-distributor configuration are the same as any of these prototype sites, the predicted pollution concentrations would be the same as for the prototype site. The prototype sites were also selected to provide locations where the maximum pollution would be expected to occur.

Illustration 93 **Air Quality Study Impact Areas and Measurement Sites**

■	**Primary Site**
●	**Secondary Site**
▲	**Tunnel Site**
- - - - - - - -	**Limits of Primary Impact Area**
....	**Limits of Secondary Impact Area**

North


0
¼
½ mile
West Side Highway
Tenth Ave
Ninth Ave
Eighth Ave
Avenue of the Americas
Fifth Ave
Madison Ave
Park Ave
Lexington Ave
Third Ave
Second Ave
Franklin D. Roosevelt Dr
Wall St
Chambers St
Christopher St
W 14th St
W 23rd St

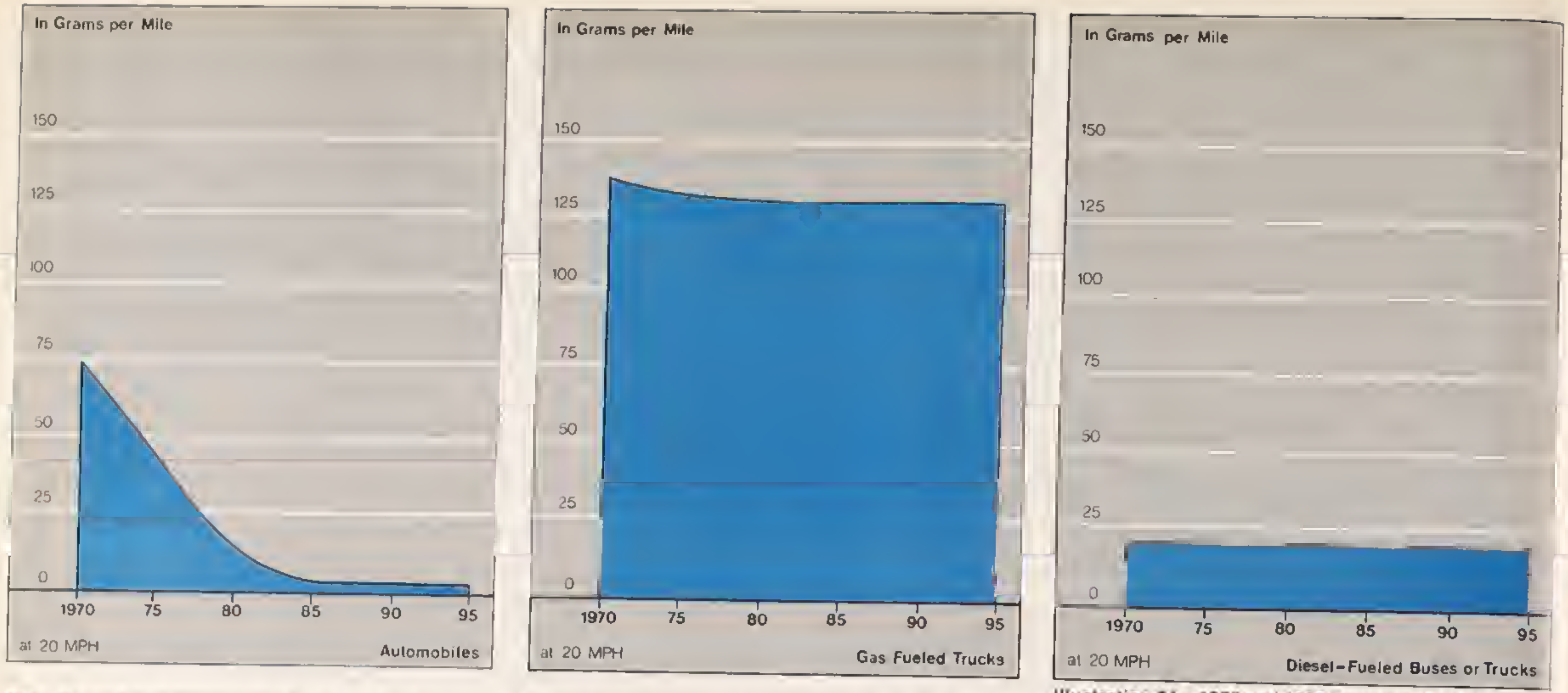


Illustration 94 **1972 and 1995 Emission Factors**

Data The pollution measurement program for the primary impact area studies is described in the air quality portion of Section 2. The carbon monoxide data collected during this measurement program was used in the primary area studies. In addition, data from another New York air quality study was used in this analysis.[62] Data from three prototypical sites from this previous study were also analyzed. These sites included the Brooklyn-Queens Expressway at Hicks Street, a depressed six-lane roadway; the Grand Central Parkway at Parsons Boulevard, a depressed six-lane roadway below an overhanging service road; and the Bruckner Expressway at White Plains Road, an at-grade, open six-lane road. Pollution, traffic, and meteorology (wind speed, stability, and direction) for the Project sites were measured directly. Data for these same factors for the other sites was taken from the published report describing the program. Predicted 1995 traffic volumes used for pollution concentration predictions were taken directly from Project traffic studies without modification. Traffic parameters other than volume were derived through special analyses.

The ultimate purpose of predicting traffic in an air quality study is to determine the pollutant emissions that will be expected from the traffic. The Federal EPA classifies emissions from three categories of motor vehicles—light duty gasoline powered, heavy duty gasoline powered, and heavy duty diesel powered. Each of these motor vehicle types emits different quantities of carbon monoxide. The criteria used for defining light and heavy duty vehicles are defined by the Federal EPA as follows:

■ Light duty vehicle—any motor vehicle either (a) designated primarily for the transportation of property and rated at 6000 pounds GVW (gross vehicle weight) or less, or (b) designated primarily for the transportation of persons and having a capacity of 12 persons or less.

■ Heavy duty vehicle—any motor vehicle either (a) designated primarily for the transportation of property and rated at more than 6000 pounds GVW, or (b) designated primarily for the transportation of persons and having a capacity of more than 12 persons.[63]

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[62] **Study of Air Pollution Aspects of Various Roadway Configurations,** General Electric Company Urban Expressway Study, New York City Department of Air Resources, September 1971.

[63] **Compilation of Air Pollutant Emission Factors,** U.S. Environmental Protection Agency, Publication AP-42, 2nd Edition, April 1973.

In order to compute properly the emissions from the traffic, it is necessary to know the traffic mix in terms of the number of each of the three emission classification categories of vehicles in the traffic stream. Traffic data for the Project studies was calculated only in terms of two categories—four-tired vehicles and six-tired vehicles, termed cars and trucks respectively. It was necessary, therefore, to determine the number of four-tired vehicles that are rated at more than 6000 pounds and are therefore heavy duty vehicles. The remainder of the four-tired vehicles are light duty. All of the six-tired vehicles are heavy duty because they all weigh more than 6000 pounds. It is also necessary to determine what portion of the heavy duty vehicles are gasoline powered and what percentage are diesel powered. The number of diesel powered light duty vehicles is too small to represent a measurable percentage in the New York City traffic stream.

The percentage of four-tired vehicles that are heavy duty and the percentage of heavy duty vehicles that are gasoline powered were derived from detailed vehicle classification counts made by the Project staff on West Street, Twelfth Avenue, and in the vicinities of the Lincoln and Holland Tunnels. At each location, less than five percent of the four-tired vehicles could be classified as heavy duty. The portion of heavy duty vehicles that were gasoline powered varied from 64 percent to 89 percent.

Emissions for all vehicle categories were taken from the latest official Federal EPA figures. Examples of these factors at 20 miles per hour are shown in Illustration 94. It is important to note that heavy duty gasoline vehicles (trucks) are predicted to cause significantly more carbon monoxide pollution in 1995 than are light duty vehicles (automobiles). As shown in Illustration 95, one gasoline powered truck will emit about 42.5 times as much carbon monoxide as one automobile in 1995. One diesel powered truck will emit about 6.6 times as much carbon monoxide as one automobile. In 1995, on a street with 1000 automobiles per hour and only 100 gasoline trucks per hour, the trucks will contribute more than four times the carbon monoxide pollution contributed by the automobiles.

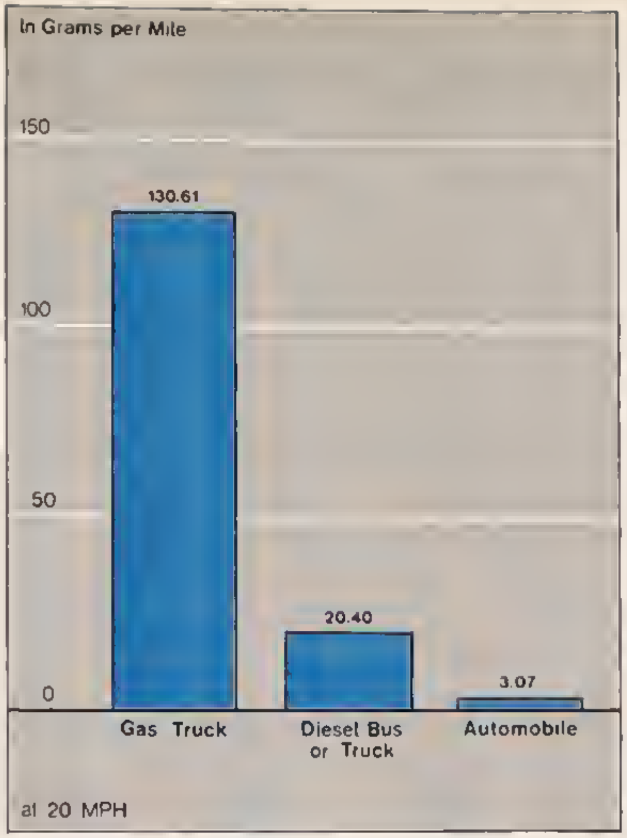

Illustration 95 1995 Comparative Emission Factors

This great difference in the potential contribution of automobiles and trucks to local pollution in 1995 is projected because the Federal EPA is pessimistic about the success of achieving efficient emission controls on heavy duty gasoline engines. This pessimism is reflected in the emission levels predicted by the Federal EPA for heavy duty gasoline vehicles in 1995. If emission control technology for heavy duty gasoline engines improves between now and 1995, or if diesel, gas turbine, or other forms of low pollution emission heavy duty engine dominate the heavy duty vehicle population, National Ambient Air Quality Standards will be met everywhere without difficulty. It is hoped that increased Federal recognition of the dominant role of heavy duty vehicles in urban air pollution will be prompted by more analyses of the type performed in this study. With such increased recognition, it is probable that solutions to the heavy duty gasoline engine emission control problem will be found, or that alternative power sources will entirely replace the gasoline engine in these vehicles. It is emphasized here, therefore, that the carbon monoxide concentrations predicted in this study for 1995 represent an extreme upper limit on such concentrations.

In order to evaluate predicted pollution concentrations in terms of the National Ambient Air Quality Standards as they are now written, it is necessary to use the most severe meteorological conditions in making such predictions. Three measures of meteorological condition are pertinent to air quality studies—atmospheric stability, wind speed and wind direction. Atmospheric stability is a measure of the change in wind speed and direction with altitude. If the atmosphere is stable, the wind speed and direction change only slightly with changes in altitude. Under these stable conditions, little vertical mixing of layers of air at different altitudes occurs and pollution dispersion through mixing in the atmosphere is slow. If the atmosphere is unstable, the wind speed and direction change considerably with changes in altitude. Under unstable atmospheric conditions, vertical mixing takes place and pollutants become rapidly diluted through mixing with cleaner air.

The specific choice of stability level, wind speed and wind direction to be used in an air quality study is a matter of judgmental interpretation of the concept of "most severe" meteorological conditions, and an analysis of historical data. In order to make the most objective interpretation of this concept, Project staff consulted the Federal EPA. Through this consultation and a review of available data, it was determined to use the stability classes and wind speeds shown in Table 47.[64]

Table 47 **Meteorological Conditions for Primary Area Studies(a)**

Case	Wind Speed (mph)	Stability Level(b)
Maximum 1 Hour CO(c) Concentrations	1.0	F
Maximum 8 Hour CO Concentrations	2.5	E

(a) Meteorological conditions developed in discussion with U.S. Environmental Protection Agency Officials.

(b) Stability levels based on the modified Cramer scheme:
E level—stable
F level—highly stable

(c) Carbon monoxide

Wind direction was chosen so as to give the highest predicted pollution concentration at each site where calculations were made. Many angles were tested at each site, but the pollutant concentrations given here are for that angle that gives the maximum concentration. It is emphasized that for the eight-hour period the predicted concentrations using the above worst case meteorology are particularly high. The likelihood of a 2.5 mile per hour wind blowing in the same direction for eight hours is extremely small.

Mathematical Modeling and Prediction The prediction of future motor vehicle generated air pollution concentrations in the urban environment in which meteorology, traffic and surrounding building configurations are highly complex and variable from place to place is a difficult and inexact science still in its early stages of development. The physical nature of the problem appears on the surface to be simple. A motor vehicle emits a pollutant from its exhaust pipe, the wind blows and carries the pollutant to other locations, thereby changing the amount of the pollutant at those locations. The difficulties in analyzing the phenomena and in predicting expected concentrations of the pollutant arise from a number of factors that complicate the basic physical phenomena that govern the movement in the atmosphere of gaseous pollutants such as carbon monoxide.

The first complication arises as soon as the pollutant comes out of the tailpipe. The moving vehicle causes turbulence in the air around the tailpipe and mixes the pollutant with the air through which the vehicle is passing. This initial turbulent mixing decreases the concentration of the pollutant even before the gas begins to spread and mix further. The exact nature of this first turbulent mixing phenomenon is not well understood and is not presently amenable to a well defined mathematical analysis. The polluted air now begins to move away from the vehicle in the direction in which the wind is blowing. The moving polluted air immediately encounters other vehicles and the air turbulence caused by their motion. Further mixing takes place. The pollution from the first vehicle mixes with that of other vehicles and continues moving downwind. Before the polluted air has left the influence of the moving vehicles, it has undergone a complex series of mixing phenomena. These phenomena cannot be described presently in mathematical terms that lead to accurate predictions of concentrations at points within the zone of vehicular generated mixing. The mass of mixed polluted air finally passes beyond the influence of the turbulence caused by the moving motor vehicles and begins to spread in a more uniform and predictable way.

Although the way in which the polluted air now moves is reasonably well understood, the rate at which the pollutant mixes with the air and becomes diluted by unpolluted air is still a subject of considerable research and debate among air pollution diffusion analysts. The particular elements of the phenomena that are not well understood are the relationships among pollution concentration, atmospheric stability, wind speed, wind direction, and the effects of urban areas with large expanses of relatively warm pavement. The phenomena are further complicated if the polluted air encounters an obstacle such as a building. The ways in which the air moves around the building, the effects of the roughness of the building surface on the mixing of the air and the pollutant, and the effect of the temperature of the building surface on the mixing are not yet amenable to accurate interpretations.

Taken togther, these complicating factors make it presently impossible to predict exactly the amount of a pollutant that will be contained in the air at any given distance from a moving motor vehicle source. Approximate solutions to the problem have been attempted in recent years. The general format of such a solution involves the development of a mathematical expression or equation which relates the pollution concentration to traffic, emissions, meteorology, building configuration, and the distance from the motor vehicle to the point at which the pollution concentration is to be predicted. An attempt is made to develop an expression which describes in mathematical terms as much of the physical phenomena as possible.

Because the physical phenomena are not presently completely understood, the expression is necessarily incomplete and will only yield approximate measures of the pollution concentrations. Contained in the mathematical expression are a number of terms that serve to relate the pollution concentration to each of the physical phenomena that are occurring. These terms can be varied by the analyst in an attempt to predict concentrations more exactly. The best values for these variable terms are chosen by comparing the predicted concentrations with those that have already been measured. The traffic, emissions, distance, building configuration and meteorology are measured along with the concentrations. The variable terms in the mathematical expression are adjusted until the concentrations match as well as possible with those that have been measured. This process is called "model calibration." The mathematical model of the real world is compared with a measurement of the real world, and the model is calibrated to agree as well as possible with what actually happens. If an accurate calibration is possible, the model can then be used to make predictions in situations where actual measurements are not immediately possible, that is, for the future. The accuracy of prediction is determined through standard statistical procedures.

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[64] "Meteorological Conditions," Project Memorandum, April 17, 1973.

For the West Side Highway Project, a new and original mathematical model was developed, because it was felt that existing models were inadequate for making accurate pollution concentration predictions in the complex Manhattan environment.[65] Calibration of the model involved a comparison of predicted results with the concentrations measured at the four primary impact area prototype sites and the three sites from a previous study, described above. The calibration insured the accuracy of the model. In addition, in order to be certain that the predicted concentrations represented the highest possible pollution values that might conceivably be present in 1995 under the prescribed traffic and meteorological conditions, the calibration procedure was structured to provide a 95 percent probability that calculated values would fall within the range of measured values. This measure of reliability is equivalent to that used in the preparation of pharmaceutical drugs for public consumption. It is felt, therefore, that the public health aspects of air pollution are properly reflected in this analysis.

Secondary Impact Area

The secondary impact area is that portion of the West Side of Manhattan which would not be directly affected by pollutants from the Project alternatives, but contains streets whose local traffic patterns and, hence, pollution concentrations are expected to be affected by Project alternatives. The significant effects of the alternatives on traffic on West Side streets would be reflected in the pollution concentrations on these streets. To the extent that a new highway could improve traffic flow and decrease traffic volumes, particularly trucks, a new highway could provide improved air quality in the local neighborhoods by comparison with the situation that would exist were the existing West Side Highway to remain in place.

The secondary area analysis parallels the work performed for the primary area. A measurement program, described in Section 2 of this Statement was carried out to collect carbon monoxide data at 15 sites in the secondary impact area. The data was used to calibrate an air pollution diffusion model, which was then used to calculate future concentrations of pollutants. These concentrations were compared with National Ambient Air Quality Standards and the various Project alternatives were then compared with each other.

Study Area The secondary area is shown in illustration 93. The 15 sites selected for measurement and subsequent pollution concentration predictions were chosen in cooperation with the New York City Department of Air Resources. The sites were selected to provide sample coverage of the three Community Planning Districts in the Study Corridor, and to insure that prototypical sites representative of a variety of Manhattan street configurations were included. The typical street configurations include full canyons (high buildings on both sides of the street), half canyons (high buildings on one side of the street, low buildings or open space on the other side), open sites (low buildings or open space on both sides of the street), and step sites (open space on one side of the street, low buildings on the other side).

Data The pollution measurement program for the secondary impact area studies is described in the air quality portion of Section 2. The carbon monoxide data collected during this measurement program was used in these studies. In addition, data from the previous New York study was used in this analysis. One prototypical site, Canal and Church Streets, was analyzed from this study, and included in the secondary impact area analysis. Traffic, emission and meteorological data for the secondary area studies were derived from the same sources as for the primary impact area studies.

The assumptions to be made regarding worst case meteorological conditions are slightly different from those described in the primary impact area analysis. These assumptions were developed in cooperation with the Federal EPA and are presented in Table 48. Note that stability level does not enter into the assumptions in the secondary impact area analysis. It has been concluded by a number of researchers, as well as by the Federal EPA, that stability level should not be included in the analysis of pollution concentrations in urban street corridors. The diffusion of the pollutants is dominated by wind speed and direction. Maximum concentrations occur at low wind speeds and when the wind blows parallel to the line of traffic (along the length of the street rather than across the street). Thus, in the secondary impact area analysis, the wind was assumed to blow only in this direction.

Table 48 **Meteorological Conditions for Secondary Area Studies**

Case	Wind Speed
Maximum one-hour CO(a) concentrations	1.0 mph
Maximum eight-hour CO concentrations	1.6 mph

(a) Carbon Monoxide

Mathematical Model and Prediction As described for the primary impact area studies, a mathematical model was developed and calibrated for the secondary impact areas. Again, as with the primary impact area analysis, the calibration procedure was structured to provide a 95 percent probability that the calculated values would fall within the range of measured values.

Tunnel Areas

The streets in the areas around the Lincoln and Holland Tunnels contain a complex pattern of traffic that would change significantly with certain project proposals. With these changes in traffic will come concomitant changes in air pollution concentrations. It is necessary, therefore, to analyze the impacts of the alternatives on the air quality in the tunnel areas.

Two sub-areas within the tunnel impact areas should be considered. The areas immediately adjacent to the tunnel portals are expected to be unaffected by change in the interchange configurations. These areas are not presently congested except when problems exist on the New Jersey side of the tunnels. In the future, there would be no difference among the alternatives as they directly affect the areas immediately adjacent to the portals. Thus, no study was made of these areas.

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[65] "Concentration of Motor Vehicle Generated Pollutants in the Vicinity of Urban Highways," Proceedings of the Eighth Annual Meeting, Society of Engineering Science, November 1970, Volume II, pages 565-587; "Effect of Highway Configurations on Environmental Problems—Dynamics of Highway Associated Air Pollution," Procedings of the Second International Clean Air Congress, 1971, Paper No SU-12E; "Motor Vehicle Generated Air Pollution, Review and Extension of Methodology," 65th Annual Meeting of Air Pollution Control Association, June 1972, Paper No. 72-142.

The second sub-area of importance includes the local streets that provide collector-feeder service to the tunnels. Because these streets represent a complex array of traffic patterns which would shift with the Project alternatives, it is not feasible to make a point-by-point study of these streets to determine the overall air quality impacts of the alternatives. It was, therefore, considered to be reasonable to anlyze the changes in vehicle miles traveled during the peak periods under each alternative in those quarter-mile grid squares that contained the tunnel areas. These vehicle miles traveled are then converted to pollutant emissions which are compared among the alternatives to determine their relative air quality impacts.

Study Area The Holland Tunnel impact area is covered by two Tri-State quarter-mile square areas, bounded on the north by Houston Street, on the east by the Bowery, on the south by Murray Street, and on the west by Broadway. The Lincoln Tunnel impact area is also contained in two Tri-State quarter-mile square areas, bounded on the north by 50th Street, on the east by Eighth Avenue, on the south by 40th Street, and on the west by Eleventh Avenue. The grid squares contain the portal areas as well as the principal feeder streets for both New York bound and New Jersey bound traffic. The impact of Project alternatives on streets outside of these areas is expected to be small in comparison with the changes to be expected inside the impact areas. In addition, changes occurring within the grid squares are representative of the changes that would occur in adjacent grid squares, and thereby indicate the relative effects of the Project alternatives.

Data Vehicle miles traveled were taken directly from the Project traffic study computer output, which contained detailed summaries by Tri-State quarter-mile grid square for morning and afternoon peak traffic. No modifications of these data were made.

Table 49 **Identification of Ventilation Buildings and Adjacent Sensitive Receptors**

Building Designation (a)	Location	Typical Sensitive Receptors in Study Area
Inboard:		
$I_1 - 2$ (2)	Between Piers 21 and 25	Washington St. Urban Renewal Project Apartments/Proposed Community College
$I_1 - 3$	Between Leroy and Clarkson Sts. at West St.	West Village Housing Apartments (WVHA)
$I_2 - 3$	West Houston and West Sts.	WVHA/St. Johns Park Freight Terminal
I – 4 (2)	Gansevoort St. Near Sanitation Plant	Warehouses/Gansevoort Meat Market
I – 5 (2)	W. 23rd St. and 11th Ave.	Warehouses/Freight yards
I – 6 (2)	39th St. between 10th & 11th Aves.	Industrial/St. Raphael's Church
Outboard:		
0 – 2 (4)	South of Pier 25	Washington St. Urban Renewal Project Apartments/Proposed Community College
$0_1 - 3$ (2)	500 feet west of $I_2 - 3$	WVHA/St. Johns Park Freight Terminal
$0_2 - 3$ (2)	800 feet west of $I_1 - 3$	WVHA
0 – 4 (4)	W. 14th St. and Pier 57	Warehouses/Light Industry
0 – 5 (4)	W. 27th St. and 12th Ave.	Warehouses/Light Freight yards
0 – 6 (2)	39th St. between 10th & 11th Aves.	Industrial/St. Raphael's Church

(a) Figure in Parentheses is the number of ventilation buildings at the same location associated with the designation.

Ventilation Buildings

The Inboard and Outboard alternatives each include sections of roadway which are enclosed and mechanically ventilated. These enclosed sections are designed to protect sensitive land use areas from excessive noise and air pollution caused by the flow of vehicles on a new highway.

Inside these enclosed sections, vehicular generated pollutants are kept diluted at safe levels by means of mechanical ventilation systems which supply fresh air uniformly throughout the length of the section. Exhaust air from the section is collected in a duct system and discharged into the atmosphere by exhaust fans and stacks housed in the ventilation buildings. This study evaluated impacts of the pollution emitted from these buildings by comparing the predicted concentrations of pollutants at locations adjacent to the ventilation buildings with the appropriate National Ambient Air Quality Standards.

Study Area In all, the impacts of 28 ventilation buildings were studied—ten of the buildings associated with the Inboard, and 13 associated with Outboard alternative. Each of these buildings has its own study area, which includes the nearest sensitive land uses, such as apartment houses. Table 49 contains the locations of all the ventilation buildings which were studied, and the critical land-use locations associated with each vent building.

Data The amount of pollutants leaving each of the vent building stacks in 1995 was computed by using the maximum enclosed section traffic and the characteristics of the mechanical ventilation system to find the pollutant concentration at the exit point of the stack.

For those sections used exclusively by diesel vehicles, the most important pollutant is suspended particulates, a major component of diesel exhaust. For those sections that have mixed traffic including both gasoline powered and diesel vehicles, the major exhaust component is carbon monoxide.

All traffic figures were taken from the Project traffic and transit studies. Vehicle pollution emissions were derived in the same manner as for all other studies. Worst case meteorological conditions were derived from meteorological data collected at the four primary impact area sites. Several combinations of wind speed and stability class, representative of worst case meteorology were tested at each vent building in order to determine which combination would give maximum pollution concentrations. It is important to note here that the lowest wind speed may not necessarily result in the higher pollutant concentration when the source is an elevated single point such as a ventilation building exhaust stack. Wind speed has two effects on the stream of pollutants emitted by the stack. These two effects tend to counteract each other. As the wind speed increases, the pollution stream tends to deflect or bend from the vertical towards the horizontal, thereby increasing concentrations downwind of the building. This phenomenon can be seen on a windy day when the visible smoke from an industrial stack flows horizontally away from the top of the stack. This same action may also decrease downwind concentrations because the high wind speed tends to increase the mixing of the pollutants with cleaner air, thereby causing greater dilution of the pollutant. It is necessary, therefore, to calculate the specific intermediate wind speed at which the maximum downwind pollutant concentrations occur.

Mathematical Model and Predictions A standard mathematical model which predicts the downwind concentration of pollutants emitted from a stack was used to calculate carbon monoxide and particulate concentrations at each of the critical land-use sites in the vicinity of the vent buildings.[66]

Analysis of Alternatives

The results of the five studies described above are discussed in this section. These results are presented in a variety of formats, each intended for the specific study involved to provide a clear understanding of the impacts of each Project alternative and the relative impacts among the alternatives. In addition, where possible, predicted air quality is compared with National Ambient Air Quality Standards.[67]

Three types of data are presented, depending on the particular study—vehicle miles traveled, pollutant emissions, or pollutant concentrations. Vehicle miles traveled indicate changes in both the total volume of traffic moving in a region, and in the length of average trips made by that traffic. If traffic volume decreases, or if trip lengths decrease with a concomitant decrease in vehicle miles traveled, it may be expected that air quality will improve because fewer pollutants will be emitted by motor vehicles. Pollutant emissions indicate the amount of a pollutant, usually measured in tons per day (or per year) of the particular pollutant emitted by motor vehicles traveling over a specified area, such as the Project impact area. A reduction in pollutant emissions will improve air quality. Pollutant concentrations are given in units of parts per million (ppm). This unit describes the volume of a pollutant contained in a specified volume of air at a specific point in space. For example, one ppm of carbon monoxide indicates that each cubic inch of air contains one millionth of a cubic inch of carbon monoxide. The lower the pollutant concentration, the higher the air quality.

The National Ambient Air Quality Standards are prescribed only for pollutant concentrations, and are related to the measurement of those concentrations over various time periods. For carbon monoxide, both one-hour and eight-hour standards are currently in force. The one-hour standard requires that the average carbon monoxide concentration measured over any one-hour period shall not exceed 35 ppm more than once per year. The eight-hour standard requires that the average carbon monoxide concentration measured over any eight-hour period shall not exceed 9 ppm more than once per year.

Because of the restriction that the standards may not be exceeded more than once per year, it is necessary to calculate peak pollutant concentrations. As described in the methodology section, this requirement implies that worst case meteorology must be combined with peak traffic to calculate pollutant concentrations for comparison with the standards. In addition to the peak or maximum concentrations, calculations were made for typical day one-hour and eight-hour concentrations. These values were computed by using peak traffic, but typical wind speed, wind direction and stability class rather than worst case meteorological conditions. The typical-day values are the pollution concentrations that would most probably be measured if a random choice of one-hour or eight-hour period during the year was made for taking a measurement. An examination of these typical-day values will indicate that they are usually more than 50 percent lower than the peak values. This large difference between peak and typical-day values is due to the high sensitivity of pollution concentrations to meteorological conditions. It is again emphasized that the peak values are computed for worst case meteorology in order to satisfy the constraints imposed by the National Ambient Air Quality Standards that standard values may not be exceeded more than once per year.

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[66] "National Primary and Secondary Ambient Air Quality Standards," U.S. Environmental Protection Agency, Federal Register, Volume 36, No. 84, page 8187, Section 410.8, April 30, 1971; **Workbook of Atmospheric Dispersion Estimates**, U.S. Environmental Protection Agency, Publication AP-26, 1970.

[67] **Recommended Guide for the Prediction of the Dispersion of Airborne Effluents**, American Society of Mechanical Engineers, 1968.

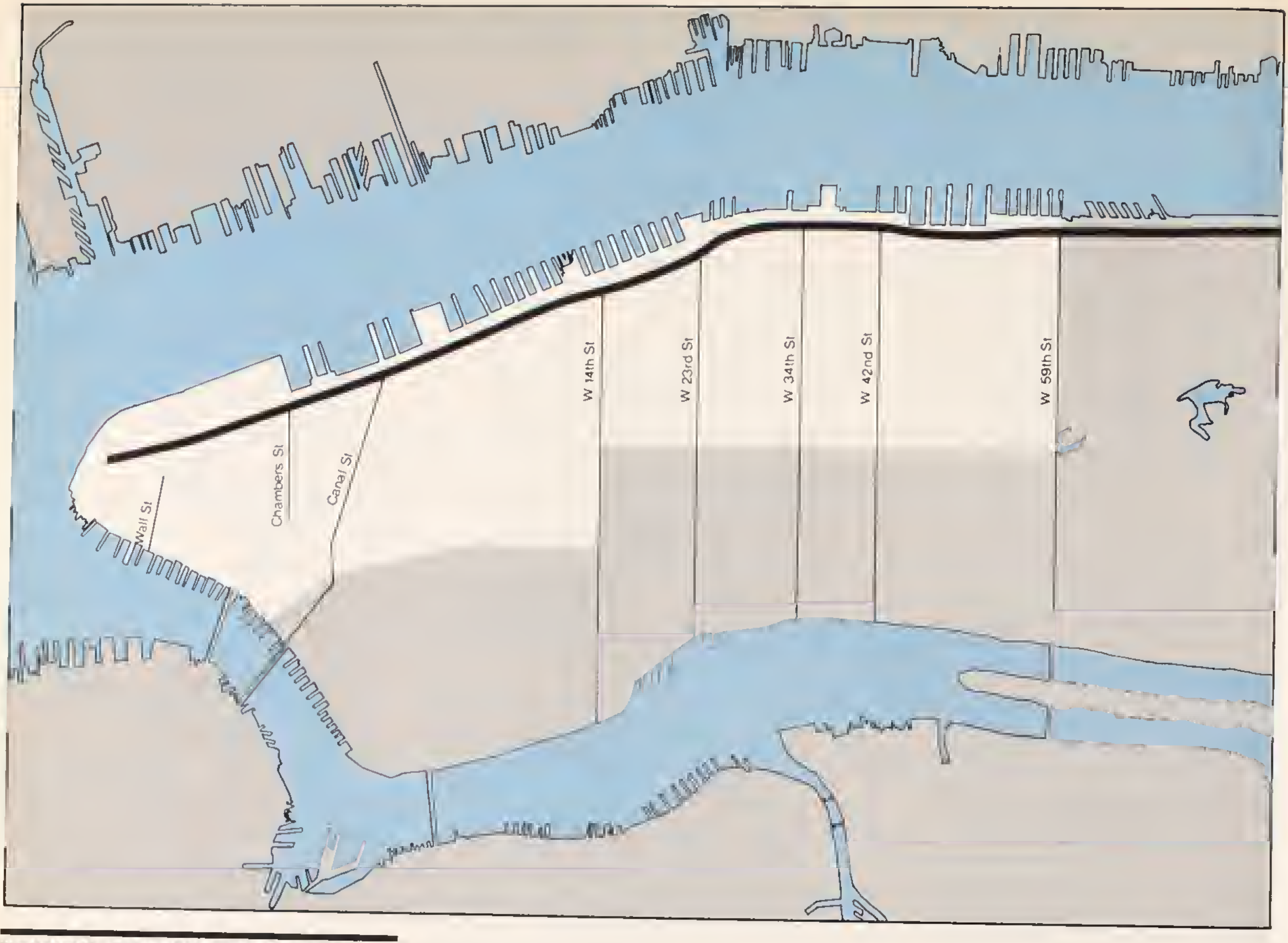

Illustration 96 Regional Air Quality Study Impact Area

☐ Impact Area

North

Regional Study

Table 50 gives the results of the regional analysis. Within the accuracy of the prediction methodology, there would be no measurable difference among the five alternatives with respect to regional emissions of hydrocarbons and nitrogen oxides in 1995. Regardless of which alternative is chosen, there would be about 473 tons per day of hydrocarbons and 446 tons per day of nitrogen oxides emitted from the Region.

Earlier in this section, it was mentioned that the City Air Resources Commissioner stated at a May 2, 1973, meeting: "Regional air quality would not be affected by the highway unless the vehicle miles traveled on the new West Side Highway exceeded one percent of the total regional vehicle miles traveled." From Table 50, it can be seen that vehicle miles traveled in the Project impact area—only a portion of which is directly attributable to the West Side Highway—account for less than eight tenths of one percent of total regional vehicle miles traveled.

If emissions from the Project impact area are compared directly with emissions from the Region, it must also be concluded that the construction and operation of a new facility would not adversely affect regional air quality. The difference in hydrocarbon emissions between either the Outboard or Inboard alternative and the Maintenance alternative is 0.1 tons per day. This represents only two-hundredths of one percent of the regional emissions of 473 tons of hydrocarbon per day. For nitrogen oxide, the same calculations show that the Outboard or Inboard alternatives would contribute less than seven-hundredths of one percent of the regional nitrogen oxides emissions of 446 tons per day.

Table 50 **Daily Vehicle Miles Traveled (VMT) and Daily Emissions Comparisons for 1972 and 1995**

Miles in millions, emissions in tons of hydrocarbons (HC) and nitrogen oxides (NOx)

	VMT 1972	VMT 1995	Emission 1972		Emission 1995	
			HC	NO_x	HC	NO_x
19 County Study Area (all options)	211	236	2150	1195	473	466
Manhattan						
Maintenance	6.4	6.8	85	35	27.2	16.1
Reconstruction	–	6.8	–	–	27.1	16.2
Inboard	–	6.7	–	–	26.8	16.1
Outboard	–	6.7	–	–	26.9	16.1
Arterial	–	6.7	–	–	27.0	16.0
West Side Highway Impact Area						
Maintenance	1.56	1.71	22.6	8.6	8.1	4.4
Reconstruction	–	1.75	–	–	8.2	4.6
Inboard	–	1.76	–	–	8.2	4.7
Outboard	–	1.78	–	–	8.2	4.7
Arterial	–	1.66	–	–	8.0	4.4

If the entire island of Manhattan is included in the analysis, the two alternatives with an interstate highway would contribute to a decrease in hydrocarbon emissions from what the emissions would be under the Maintenance alternative. There is no measurable difference in the nitrogen oxides emissions for Manhattan between the Inboard, Outboard and Maintenance alternatives. It should be noted that Manhattan hydrocarbon emissions in 1995 represent less than six percent of the regional emissions of hydrocarbons, and less than four percent of the nitrogen oxides emissions. Finally, Table 50 indicates that the difference between the hydrocarbon emissions for the Maintenance, Inboard and Outboard alternatives for the Project impact area is less than four tenths of one percent of the hydrocarbon emissions for Manhattan.

In conclusion, regional emissions of hydrocarbons and nitrogen oxides will decrease substantially in the future due to the vehicle emission regulations of the Federal EPA. None of the Project alternatives would either hasten or retard this expected improvement in regional air quality, and residents of the Metropolitan New York Air Basin can therefore expect considerable future decreases in the production of photochemical smog.

Primary Impact Area
Carbon monoxide concentrations were calculated at the building line on West Street-Twelfth Avenue at the same four locations where pollutant measurements were made in 1972. The predicted concentrations are highly dependent on the traffic volumes and in particular on the truck volumes. The northbound truck volumes on West Street-Twelfth Avenue are the most critical traffic information used in the prediction, because these sources are the nearest to the building line. In all cases, the highest pollutant concentrations were obtained at the locations with the largest truck volumes, and the lowest pollutant concentrations were obtained at the locations with the lowest truck volumes. In the following sections, the predicted concentrations are analyzed for each alternative and a comparison is made among the alternatives.

Maintenance Table 51 shows the predicted peak and typical-day carbon monoxide concentrations for the year 1995 for the Maintenance alternative. None of the predicted concentrations exceeds either the one-hour (35 ppm) or eight-hour (9 ppm) National Ambient Air Quality Standards for carbon monoxide.

The low predicted concentrations are due to a number of factors. First, the Maintenance alternative would continue to function as an automobile-only facility. Trucks would continue to be prohibited from using the highway and would have to use local streets. Second, it has been assumed for the Maintenance alternative that no improvements would be made to either West Street or Twelfth Avenue. These streets, which run discontinuously under or alongside the existing Highway, provide only a low level of traffic service and do not function efficiently either as a collector-distributor for the Highway or as an alternative north-south route. The inability of the Highway to accommodate trucks, and the poor condition of West Street-Twelfth Avenue as an alternate transportation facility, result in low traffic and in particular, low truck volumes at all of the primary impact area prediction sites for the Maintenance alternative. Because no trucks would be diverted in the Maintenance alternative, the air pollution is retained in the secondary impact area.

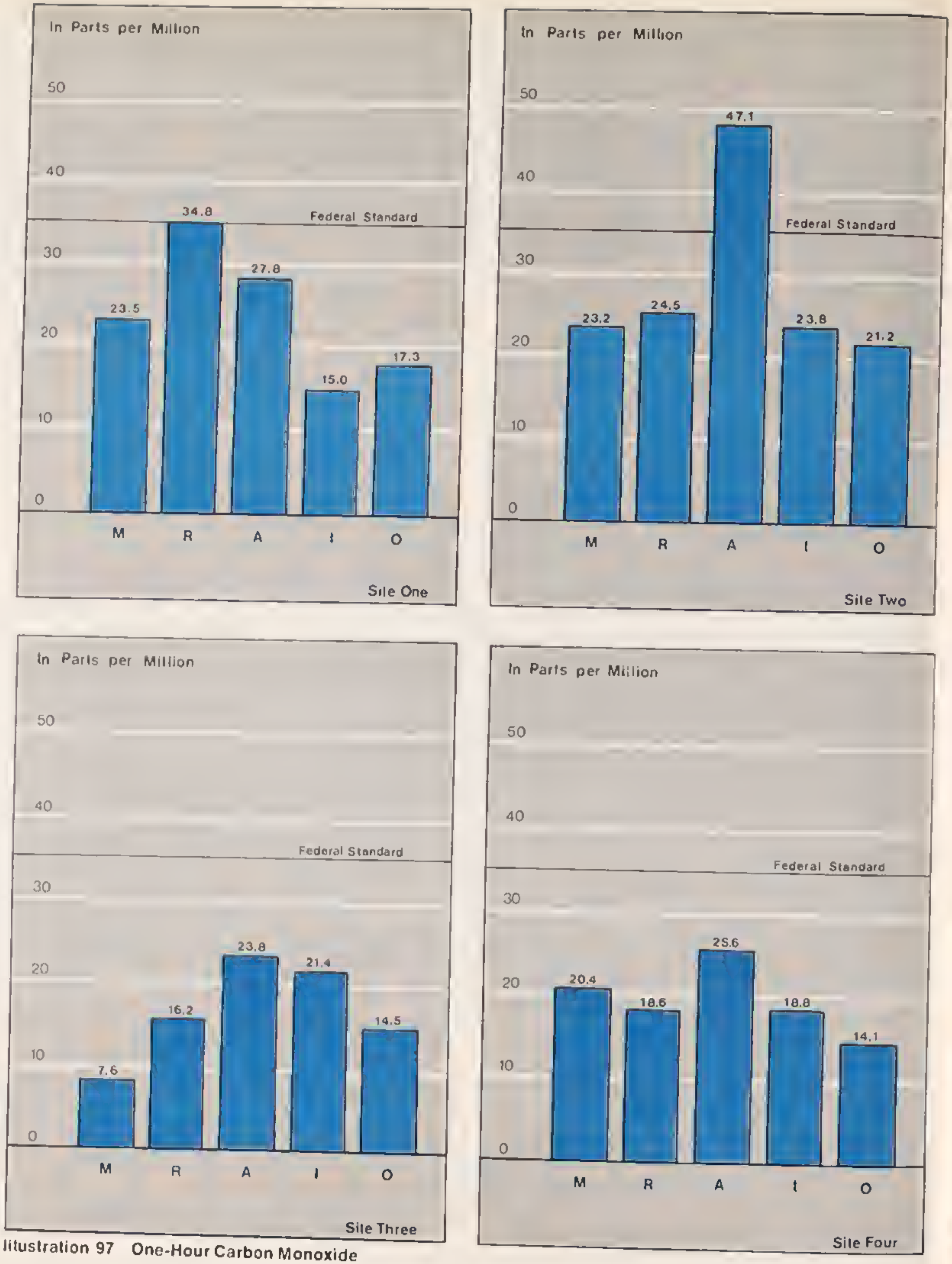

Illustration 97 One-Hour Carbon Monoxide Concentrations at Primary Impact Sites in 1995 (a)

(a) M: Maintenance Alternative
R: Reconstruction Alternative
A: Arterial Alternative
I: Inboard Alternative
O: Outboard Alternative

Table 51 **Predicted Carbon Monoxide Concentrations in the Primary Impact Area for 1995 for the Maintenance Alternative**
All values in parts per million

Site Location (a)	Peak 1 Hour	Peak 8 Hour	Typical Day 1 Hour	Typical Day 8 Hour
1 Murray & West Sts.	23.5	7.2	2.6	1.1
2 Christopher & West Sts.	23.2	7.2	2.2	1.7
3 27th St. & 12th Ave.	7.6	3.2	1.6	1.1
4 41st St. & 12th Ave.	20.4	5.1	2.4	1.7
Standard (b)	35.	9.	35.	9.

(a) Predicted concentrations calculated at building line.

(b) National Ambient Air Quality Standards.

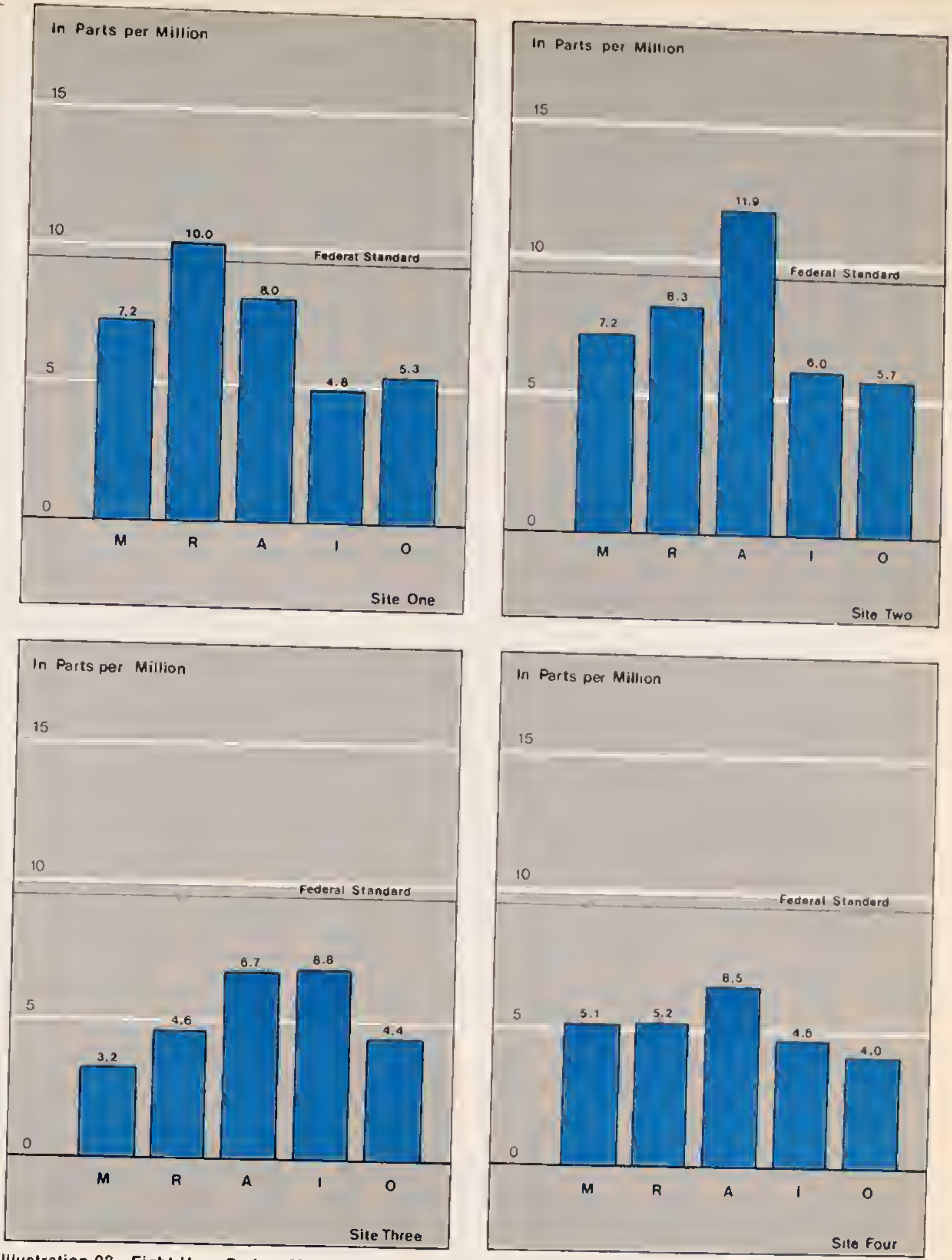

Illustration 98 **Eight-Hour Carbon Monoxide Concentrations at Primary Impact Sites in 1995** (a)

(a) M: Maintenance Alternative
R: Reconstruction Alternative
A: Arterial Alternative
I: Inboard Alternative
O: Outboard Alternative

Reconstruction Table 52 shows the predicted peak and typical-day carbon monoxide concentrations for the year 1995 for the Reconstruction alternative. Only the peak eight-hour concentration at Site 1, located at Murray and West Streets, would exceed the standards.

The Reconstruction alternative modifications would be made to accommodate trucks on the highway. West Street-Twelfth Avenue would be reconstructed to provide three through-traffic lanes in each direction. The result of these improvements and modifications is that some truck trips would be diverted from the local streets to the highway corridor. The result of this diversion is that at Site 1 the peak eight-hour predicted concentration would exceed the standard, and the peak one-hour predicted concentration would be just below the standard. Predicted concentrations at the remaining sites are well below the National Ambient Air Quality Standards.

Table 52 **Predicted Carbon Monoxide Concentrations in the Primary Impact Area for 1995 for the Reconstruction Alternative**
All values in parts per million

	Peak 1 Hour	Peak 8 Hour	Typical Day 1 Hour	Typical Day 8 Hour
1 Murray & West Sts.	34.8	**10.0**	3.3	1.2
2 Christopher & West Sts.	24.5	8.3	2.3	1.8
3 27th St. & 12th Ave.	16.2	4.6	1.9	1.4
4 41st St. & 12th Ave.	18.6	5.2	2.3	1.8
Standard(b)	35.	9.	35.	9.

(a) Predicted concentrations calculated at building line.

(b) Concentrations exceeding National Ambient Air Quality Standards shown in bold type.

Arterial Table 53 shows the predicted peak and typical-day carbon monoxide concentrations for the year 1995 for the Arterial alternative. Both the peak one and eight-hour concentrations at Site 2, located at Christopher and West Streets, would exceed the standards. All of the other concentrations are below the standards.

The Arterial alternative would involve replacing the existing West Side Highway and West Street with a six-lane, at-grade, arterial roadway and an intermittent adjacent service road. The Arterial alternative would result in a substantial diversion of truck trips from the local streets to the new arterial. The roadway is an at-grade facility with motor vehicle pollutant sources located close to the pollution receptor locations at the building line on West Street. Consequently, peak concentrations at some locations, such as those shown in Table 53 for Site 2, might exceed the National Ambient Air Quality Standards.

Table 53 **Predicted Carbon Monoxide Concentrations in the Primary Impact Area for 1995 for the Arterial Alternative**
All values in parts per million

Site Location(a)	Peak 1 Hour	Peak 8 Hour	Typical Day 1 Hour	Typical Day 8 Hour
1 Murray & West Sts.	27.8	8.0	2.6	2.1
2 Christopher & West Sts.	**47.1**	**11.9**	3.7	2.8
3 27th St. & 12th Ave.	23.8	6.7	2.6	1.9
4 41st St. & 12th Ave.	25.6	6.5	2.7	1.9
Standard(b)	35.	9.	35.	9.

(a) Predicted concentrations calculated at building line.

(b) Concentrations exceeding National Ambient Air Quality Standards shown in bold type.

Inboard Table 54 shows the predicted peak and typical-day carbon monoxide concentrations for the year 1995 for the Inboard alternative. None of the predicted concentrations exceeds the National Ambient Air Quality Standards for carbon monoxide.

The Inboard alternative would involve replacement of the existing Highway by a six-lane interstate highway, generally located near the Hudson River bulkhead line, close to the existing right-of-way. This alternative would also involve a reconstructed six-lane West Street-Twelfth Avenue, which would act as a service road or collector-distributor for the entire length of the highway. Both the new highway and the reconstructed service road would accommodate trucks. A considerable length of the highway would be built as a depressed, covered and ventilated section. Pollutants emitted in such sections would be gathered in the ventilation system of the covered section and emitted from tall exhaust stacks, with sufficient velocity to cause almost negligible ground level concentrations under most meteorological conditions. The Inboard alternative would result in a considerable diversion of truck traffic from the local streets to the highway corridor. However, due to the large number of sections which are either totally covered and ventilated or partially covered, low pollutant concentrations would be obtained on streets along the highway for this alternative.

Table 54 **Predicted Carbon Monoxide Concentrations in the Primary Impact Area for 1995 for the Inboard Alternative**
All values in parts per million

Site Location(a)	Peak 1 Hour	Peak 8 Hour	Typical Day 1 Hour	Typical Day 8 Hour
1 Murray & West Sts.	15.0	4.8	1.9	1.5
2 Christopher & West Sts.	23.8	6.0	2.3	1.5
3 27th St. & 12th Ave.	21.4	6.8	2.3	2.0
4 41st St. & 12th Ave.	18.8	4.6	2.3	1.9
Standard(b)	35.	9.	35.	9.

(a) Predicted concentrations calculated at building line.

(b) National Ambient Air Quality Standards.

Outboard Table 55 shows the predicted peak and typical-day carbon monoxide concentrations for the year 1995 for the Outboard alternative. None of the predicted concentrations would exceed the National Ambient Air Quality Standards for carbon monoxide.

The Outboard alternative would involve replacement of the existing West Side Highway by a six-lane interstate highway located in landfill near the pierhead line for most of its length, and built for a portion of its length as a covered and ventilated section. There would be a reconstructed West Street-Twelfth Avenue, which would run the entire length of the highway and serve as a service road or collector-distributor for the highway. Both the new highway and the reconstructed service road would accommodate trucks. The Outboard alternate would result in a considerable diversion of truck traffic from the local streets to the highway and highway corridor. However, due to the considerable distance between the mainline highway at the pierhead line, and receptor locations at the building line on West Street, and because large portions of the mainline highway would be covered sections, pollutants emitted by motor vehicles on the highway generally contribute little to local pollutant concentrations. Consequently, low pollutant concentrations would be obtained on streets near the highway for this alternative.

Table 55 **Predicted Carbon Monoxide Concentrations in the Primary Impact Area for 1995 for the Outboard Alternative**
All values in parts per million

Site Location(a)	Peak 1 Hour	Peak 8 Hour	Typical Day 1 Hour	Typical Day 8 Hour
1 Murray & West Sts.	17.3	5.3	2.0	1.7
2 Christopher & West Sts.	21.2	5.7	2.2	1.5
3 27th St. & 12th Ave.	14.5	4.4	1.7	1.2
4 41st St. & 12th Ave.	14.1	4.0	1.9	1.5
Standard(b)	35.	9.	35.	9.

(a) Predicted concentratrons calculated at building line.

(b) National Ambient Air Quality Standards.

Table 56 **Predicted Carbon Monoxide Concentrations in the Primary Impact Area for Peak Periods**
All values in parts per million

	Existing West Side Highway(a)		Maintenance		Reconstruction		Arterial		Inboard		Outboard	
	1 Hr	8 Hr	1 Hr	8 Hr	1 Hr	8 Hr	1 Hr	8 Hr	1 Hr	8 Hr	1 Hr	8 Hr
Site Location(b)												
1 Murray & West Sts.	**76.2**	**24.5**	23.5	7.2	34.8	**10.0**	27.8	8.0	15.0	4.8	17.3	5.3
2 Christopher & West Sts.	**42.5**	**15.9**	23.2	7.2	24.5	8.3	**47.1**	**11.9**	23.8	6.0	21.2	5.7
3 27th St. & 12th Ave.	26.7	**9.4**	7.6	3.2	16.2	4.6	23.8	6.7	21.4	6.8	14.5	4.4
4 41st St. & 12th Ave.	**122.7**	**28.8**	20.4	5.1	18.6	5.2	25.6	6.5	18.8	4.6	14.1	4.0
Standard(c)	35.	9.	35.	9.	35.	9.	35.	9.	35.	9.	35.	9.

(a) Predicted for 1972; all others for 1995.

(b) Predicted concentrations calculated at building line.

(c) Concentrations exceeding National Ambient Air Quality Standards shown in bold.

Comparison Table 56 shows the predicted peak carbon monoxide concentrations in 1995 for the various alternatives, and in 1972 for the existing West Side Highway.

In general, the pollutant concentrations for 1972 are higher than those predicted for 1995. This is due to the stringent Federal automotive emission standards. Automotive carbon monoxide emission factors for 1995 will be less than ten percent of the 1972 values. However, truck carbon monoxide emission factors will change only slightly between 1972 and 1995. The result of the Federal emission standards is that, in general, in urban areas, carbon monoxide concentrations will be considerably reduced by 1995, when compared to 1972 values.

An examination of Table 56 indicates that in 1995 the Arterial alternative would result in the highest pollutant concentrations in the primary impact area, of all of the alternatives. This is due to the large number of trucks which would be diverted from the local streets to the Arterial, and to the fact that for this alternative both the Arterial roadway and the collector-distributor would be very close to the receptor locations at the building line on West Street. The Reconstruction alternative would result in lower pollutant concentrations than the Arterial alternative in the primary impact area. This alternative would result in only a limited diversion of trucks. The Maintenance alternative would result in even lower pollutant concentrations, since the highway for this case, the existing Highway, does not accommodate any trucks, and therefore would create no truck diversions to the corridor. The Inboard and Outboard alternatives would result in the lowest pollutant concentrations, due to the fact that large portions of both of those interstate highway facilities would be built as covered and ventilated sections. In addition, they are farther from the receptor locations at the building line on West Street. Of all the alternatives, the Outboard would result in the lowest pollutant concentrations in the primary impact area.

Secondary Impact Area

Sixteen locations were chosen in the secondary impact area for prediction of pollutant concentrations. The 16 locations include the 15 secondary area measurement sites discussed in Section 2, and an additional site on Canal Street between Church and Mercer Streets, where measurement data was available for analysis. At each of these sites, carbon monoxide concentrations were predicted for the year 1995 for a peak and for a typical day one-hour and eight-hour period. Results for each alternative are compared with the National Ambient Air Quality Standards in Tables 57-61. The Project alternatives are then compared in Table 62.

Two factors make the greatest contribution to pollutant concentrations in an urban street. The first and most important factor is the number of trucks present in the street. The carbon monoxide emissions from a single truck in 1995 are equal to the emissions from about 42.5 automobiles. The effect of this large difference in emissions is shown in Illustration 96.

For secondary impact area Site 3, Church Street between Leonard and Worth Streets, the eight-hour peak carbon monoxide concentrations for the Maintenance alternative are shown for a variety of conditions. If all 785 automobiles and 307 trucks are operating on this street in 1995, the eight-hour carbon monoxide concentration would be 19.8 ppm, 220 percent over the 9 ppm standard. The trucks contribute 89 percent of this pollution even though they represent only 28 percent of the total traffic. In order to reach the 9 ppm standard, it would be necessary to remove 204 trucks, or 66 percent of those operating. Even with only 103 trucks, or 12 percent of the traffic remaining on the street, their contribution to the pollution would be 76 percent. The automobiles contribute only 2.2 ppm to the total pollution concentration, a value well below the standards, and only 11 percent of the maximum concentration

Table 57 **Predicted Carbon Monoxide Concentrations in the Secondary Impact Area for 1995 for the Maintenance Alternative**
All values in parts per million

Site Location(a)	Peak 1 Hour	Peak 8 Hour	Typical Day 1 Hour	Typical Day 8 Hour
1 Broadway between Park & Murray Sts.	9.2	6.7	6.3	4.3
2 Broadway between Pine & Wall Sts	28.6	**12.5**	17.3	4.1
3 Church between Leonard & Worth Sts.	**51.3**	**19.8**	25.2	5.5
4 Varick between Dominick & Broome Sts.	25.6	**16.1**	14.5	5.6
5 Houston between Varick & Hudson Sts.	18.3	8.7	11.2	2.9
6 7th Ave. between Grove & Bleecker Sts.	14.1	7.5	7.3	2.4
7 Hudson at Grove St.	6.6	2.8	5.0	0.7
8 Washington between Bank & Bethune Sts.	10.3	5.8	5.6	1.9
9 8th Ave. between W. 12th & Bleecker Sts.	9.7	4.8	6.0	1.6
10 9th Ave. between 20th & 21st Sts.	17.0	8.1	12.8	2.4
11 9th Ave. between 27th & 28th Sts.	27.6	**12.2**	20.4	3.9
12 23rd St. between 9th & 10th Ave.	20.5	**11.5**	11.7	4.0
13 30th St. between 8th & 9th Ave.	17.3	**9.0**	9.5	3.1
14 50th St. between 8th & 9th Ave.	3.3	2.2	2.2	1.4
15 11th Ave. between 52nd & 53rd Sts.	11.0	5.0	6.1	1.0
16 Canal between Church & Mercer Sts.	14.2	7.3	10.6	2.3
Standard(b)	35.	9.	35.	9.

(a) Predicted concentrations calculated at curb line.

(b) Concentrations exceeding National Ambient Air Quality Standards shown in bold type.

The second factor of importance in determining pollutant concentrations in an urban street is the dispersion characteristic of the street. Dispersion refers to the movement, mixing and dilution of pollutants after they are emitted from motor vehicles. The greater the dispersion, the more the mixing and dilution and the lower the pollutant concentrations. Locations where the ratio of the height of the buildings to the width of the street is large (deep street canyons) generally have poor dispersion characteristics, and high-pollutant concentrations would be expected at such locations. A more complete discussion of the factors affecting pollutant concentrations is contained in the Project technical report on air pollution.

Maintenance Table 57 shows the predicted peak and typical-day carbon monoxide concentrations for the year 1995 for the Maintenance alternative.

Under this alternative and with peak traffic, and worst case meteorological conditions, predicted concentrations at six of the 16 secondary impact area sites would exceed either the one or eight-hour standard. The predicted peak concentrations at Sites 2, 4, 11, 12 and 13 would all exceed the eight-hour standard, and the predicted concentrations at Site 3 would exceed both the one and the eight-hour standards. Those locations having the highest predicted concentrations either have the largest truck volumes, the poorest dispersion characteristics due to tall buildings or narrow streets, or a combination of high truck volumes and poor dispersion characteristics.

Reconstruction Table 58 shows the predicted peak and typical-day carbon monoxide concentration for the year 1995 for the Reconstruction alternative. Predicted concentrations at six of the 16 secondary impact area sites would exceed either the one or eight-hour standard. At Sites 2, 4, 11, 12 and 13, the eight-hour standard would be exceeded, while at Site 3 both the one and eight-hour standards would be exceeded. Again, those locations having the highest predicted concentrations either have the largest truck volumes, the poorest dispersion characteristics or a combination of those two factors.

Table 58 **Predicted Carbon Monoxide Concentrations in the Secondary Impact Area for 1995 for the Reconstruction Alternative**
All values in parts per million

Site Location(a)	Peak 1 Hour	Peak 8 Hour	Typical Day 1 Hour	Typical Day 8 Hour
1 Broadway between Park & Murray Sts.	9.4	6.7	6.4	4.3
2 Broadway between Pine & Wall Sts	23.7	**10.7**	14.5	3.6
3 Church between Leonard & Worth Sts.	**36.1**	**14.9**	18.2	4.4
4 Varick between Dominick & Broome Sts.	23.6	**15.3**	13.5	5.3
5 Houston between Varick & Hudson Sts.	16.6	8.2	10.2	2.8
6 7th Ave. between Grove & Bleecker Sts.	12.6	6.6	6.6	2.2
7 Hudson at Grove St.	5.5	2.5	4.1	0.6
8 Washington between Bank & Bethune Sts.	9.1	5.3	5.1	1.8
9 8th Ave. between W. 12th & Bleecker Sts.	9.6	4.8	5.9	1.6
10 9th Ave. between 20th & 21st Sts.	11.6	6.0	8.8	1.5
11 9th Ave. between 27th & 28th Sts.	27.4	**12.1**	20.3	3.8
12 23rd St. between 9th & 10th Ave.	21.0	**12.0**	12.0	4.2
13 30th St. between 8th & 9th Ave.	17.1	**9.4**	9.4	3.2
14 50th St. between 8th & 9th Ave	3.7	2.3	2.4	1.5
15 11th Ave. between 52nd & 53rd Sts.	8.9	4.4	5.0	0.8
16 Canal between Church & Mercer Sts.	12.6	6.3	9.4	1.9
Standard(b)	35.	9.	35.	9.

(a) Predicted concentrations calculated at curb line.

(b) Concentrations exceeding National Ambient Air Quality Standards shown in bold type.

Arterial Table 59 shows the predicted peak and typical-day carbon monoxide concentrations for the year 1995 for the Arterial alternative. Predicted concentrations at eight of the 16 secondary impact area sites would exceed either the one or eight-hour standard. At Sites 2, 4, 5, 6, 11, 12 and 13, the eight-hour standard would be exceeded, while at Site 3 both the one and eight-hour standards would be exceeded. Again, high truck volumes and/or poor dispersion characteristics at the locations are the reasons for the high predicted concentrations at some of the sites

Inboard Table 60 shows the predicted peak and typical-day carbon monoxide concentrations for the year 1995 for the Inboard alternative. Predicted concentrations at six of the 16 secondary impact area sites would exceed the eight-hour standard. However, all of the predicted peak one-hour concentrations would be below the one-hour carbon monoxide standard The high predicted concentrations at some of the sites are again due to the high truck volumes and/or poor dispersion characteristics at these sites.

Table 59 **Predicted Carbon Monoxide Concentrations in the Secondary Impact Area for 1995 for the Arterial Alternative**
All values in parts per million

Site Location(a)	Peak 1 Hour	Peak 8 Hour	Typical Day 1 Hour	Typical Day 8 Hour
1 Broadway between Park & Murray Sts.	9.4	6.7	6.4	4.3
2 Broadway between Pine & Wall Sts.	21.5	**9.7**	13.2	3.4
3 Church between Leonard & Worth Sts.	**35.0**	**14.5**	17.7	4.3
4 Varick between Dominick & Broome Sts.	33.1	**18.9**	18.3	6.4
5 Houston between Varick & Hudson Sts.	23.1	**10.3**	14.0	3.4
6 7th Ave. between Grove & Bleecker Sts.	18.1	**9.1**	9.2	2.8
7 Hudson at Grove St.	9.7	3.7	7.3	1.1
8 Washington between Bank & Bethune Sts.	7.4	4.6	4.2	1.6
9 8th Ave. between W. 12th & Bleecker Sts.	10.1	4.9	6.2	1.6
10 9th Ave. between 20th & 21st Sts.	16.0	7.6	12.1	2.2
11 9th Ave. between 27th & 28th Sts.	27.7	**12.4**	20.5	4.0
12 23rd St. between 9th & 10th Ave.	24.0	**12.7**	13.5	4.4
13 30th St between 8th & 9th Ave.	17.2	**9.8**	9.4	3.3
14 50th St between 8th & 9th Ave.	3.4	2.2	2.2	1.4
15 11th Ave. between 52nd & 53rd Sts.	10.6	4.8	5.9	1.0
16 Canal between Church & Mercer Sts.	12.0	6.3	9.0	2.0
Standard(b)	35.	9.	35.	9.

(a) Predicted concentrations calculated at curb line.

(b) Concentrations exceeding National Ambient Air Quality Standards shown in bold type.

Table 60 **Predicted Carbon Monoxide Concentrations in the Secondary Impact Area for 1995 for the Inboard Alternative**
All values in parts per million

Site Location(a)	Peak 1 Hour	Peak 8 Hour	Typical Day 1 Hour	Typical Day 8 Hour
1 Broadway between Park & Murray Sts.	9.4	6.8	6.4	4.3
2 Broadway between Pine & Wall Sts.	21.4	**9.6**	13.2	3.3
3 Church between Leonard & Worth Sts.	31.5	**13.5**	16.1	4.1
4 Varick between Dominick & Broome Sts.	27.0	**16.6**	15.3	5.8
5 Houston between Varick & Hudson Sts.	12.1	6.4	7.6	2.3
6 7th Ave. between Grove & Bleecker Sts.	11.6	6.3	6.2	2.2
7 Hudson at Grove St.	5.8	2.5	4.4	0.6
8 Washington between Bank & Bethune Sts.	6.6	4.3	3.8	1.5
9 8th Ave. between W. 12th & Bleecker Sts.	9.8	4.8	6.0	1.6
10 9th Ave. between 20th & 21st Sts.	13.2	6.6	10.0	1.8
11 9th Ave. between 27th & 28th Sts.	25.5	**11.1**	19.0	3.5
12 23rd St. between 9th & 10th Ave.	24.6	**12.6**	13.8	4.4
13 30th St. between 8th & 9th Ave.	16.4	**9.0**	9.0	3.0
14 50th St. between 8th & 9th Ave.	3.3	2.2	2.2	1.4
15 11th Ave. between 52nd & 53rd Sts.	10.5	4.7	5.8	0.9
16 Canal between Church & Mercer Sts.	11.9	6.3	8.9	2.0
Standard(b)	35.	9.	35.	9.

(a) Predicted concentrations calculated at curb line.

(b) Concentrations exceeding National Ambient Air Quality Standards shown in bold type.

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Table 61 **Predicted Carbon Monoxide Concentrations in the Secondary Impact Area for 1995 for the Outboard Alternative**
All values in parts per million

Site Location(a)	Peak 1 Hour	Peak 8 Hour	Typical Day 1 Hour	Typical Day 8 Hour
1 Broadway between Park & Murray Sts.	9.1	6.6	6.2	4.3
2 Broadway between Pine & Wall Sts.	21.8	**9.8**	13.4	3.4
3 Church between Leonard & Worth Sts.	23.5	**11.0**	12.4	3.5
4 Varick between Dominick & Broome Sts.	30.2	**17.4**	16.8	6.0
5 Houston between Varick & Hudson Sts.	12.6	6.6	7.8	2.3
6 7th Ave. between Grove & Bleecker Sts.	12.7	6.8	6.7	2.3
7 Hudson at Grove St.	6.1	2.6	4.6	0.6
8 Washington between Bank & Bethune Sts.	7.7	4.7	4.4	1.6
9 8th Ave. between W. 12th & Bleecker Sts.	9.6	4.7	5.9	1.5
10 9th Ave. between 20th & 21st Sts.	10.7	5.6	8.1	1.3
11 9th Ave. between 27th & 28th Sts.	19.5	8.5	14.6	2.6
12 23rd St. between 9th & 10th Ave.	20.5	**11.3**	11.7	4.0
13 30th St. between 8th & 9th Ave.	16.6	**9.0**	9.1	3.0
14 50th St. between 8th & 9th Ave.	3.3	2.2	2.2	1.4
15 11th Ave. between 52nd & 53rd Sts.	10.4	4.9	5.8	1.0
16 Canal between Church & Mercer Sts.	11.5	6.0	8.7	1.9
Standard(b)	35.	9.	35.	9.

(a) Predicted concentrations calculated at curb line

(b) Concentrations exceeding National Ambient Air Quality Standards shown in bold type

Outboard Table 61 shows the predicted peak and typical-day carbon monoxide concentrations for the year 1995 for the Outboard alternative. Predicted concentrations at 5 of the 16 secondary impact area sites would exceed the eight-hour standard. However, all of the peak one-hour and typical-day predicted concentrations would be below the carbon monoxide standards. The predicted peak eight-hour concentration for Sites 2, 3, 4, 12 and 13 would all exceed the standards. Again, the high predicted concentrations at some of the sites is due to the high truck volumes and/or poor dispersion characteristics at these sites.

Comparison Table 62 shows the peak predicted one and eight-hour carbon monoxide concentrations for each of the five alternatives for the year 1995, and the peak concentrations for the year 1972.

In all cases, the 1995 predicted concentrations are considerably lower than those in 1972. This reduction is a direct result of the stringent Federal automotive emission standards. For carbon monoxide, these emission standards will result in a reduction of over 90 percent in the automotive emission factor from 1972 to 1995. Current Federal truck emission standards will result in a reduction of less than five percent when 1995 truck carbon monoxide emission factors are compared with the 1972 values. The net result of this reduction in automotive emission factor is that regardless of the highway alternative considered, the predicted carbon monoxide concentrations in the secondary impact area will be substantially lower in 1995 than those measured in or predicted for 1972. Also, the large decrease in automotive emission factors compared to the small decrease in truck emission factors helps to emphasize the dominant role that trucks play in determining future pollutant concentrations.

For 1995, the highest concentrations for the 16 sites analyzed in the secondary impact area were obtained for the Maintenance alternative. The Arterial alternative, followed closely by the Reconstruction alternative, gave the next highest concentrations, and the Inboard and Outboard alternatives resulted in the lowest predicted concentrations. The differences in predicted concentrations from alternative to alternative are strictly a function of the traffic volumes and, in particular, of the truck volumes at each of the locations.

Table 62 **Predicted Carbon Monoxide Concentrations in the Secondary Impact Area for Peak Periods**
All values in parts per million

	Existing West Side Highway(a)		Maintenance		Reconstruction		Arterial		Inboard		Outboard	
	1 Hr	8 Hr	1 Hr	8 Hr	1 Hr	8 Hr	1 Hr	8 Hr	1 Hr	8 Hr	1 Hr	8 Hr
Site Location(b)												
1 Broadway between Park & Murray	**31.6**	**21.9**	9.2	6.7	9.4	6.7	9.4	6.7	9.4	6.8	9.1	6.6
2 Broadway between Pine & Wall	**79.7**	**39.5**	28.6	**12.5**	23.7	**10.7**	21.5	**9.7**	21.4	**9.6**	21.8	**9.8**
3 Church between Leonard & Worth	**83.7**	**44.0**	**51.3**	**19.8**	**36.1**	**14.9**	**35.0**	**14.5**	31.5	**13.5**	23.5	**11.0**
4 Varick between Dominick & Broome	**84.4**	**48.8**	25.6	**16.1**	23.6	**15.3**	33.1	**18.9**	27.0	**16.6**	30.2	**17.8**
5 Houston between Varick & Hudson	25.0	**16.3**	18.3	8.7	16.6	8.2	23.1	**10.3**	12.1	6.4	12.6	6.6
6 7th Ave. between Grove & Bleecker	33.9	**19.8**	14.1	7.5	12.6	6.6	18.1	**9.1**	11.6	6.3	12.7	6.8
7 Hudson at Grove	15.7	7.9	6.6	2.8	5.5	2.5	9.7	3.7	5.8	2.5	6.1	2.8
8 Washington between Bank & Bethune	14.5	8.9	10.3	5.8	9.1	5.3	7.4	4.6	6.6	4.3	7.7	4.7
9 8th Ave. between W. 12th & Bleecker	21.7	**11.2**	9.7	4.8	9.6	4.8	10.1	4.9	9.8	4.8	9.6	4.7
10 9th Ave. between 20th & 21st	25.0	**13.9**	17.0	8.1	11.6	6.0	16.0	7.6	13.2	6.6	10.7	5.6
11 9th Ave. between 27th & 28th	**53.3**	**26.0**	27.6	**12.2**	27.4	**12.1**	27.7	**12.4**	25.5	**11.1**	19.5	8.5
12 23rd between 9th & 10th Ave.	**77.3**	**47.1**	20.5	**11.5**	21.0	**12.0**	24.0	**12.7**	24.6	**12.6**	20.5	**11.3**
13 30th between 8th & 9th Ave.	**59.7**	**29.9**	17.3	**9.0**	17.1	**9.4**	17.2	**9.8**	16.4	**9.0**	16.6	**9.0**
14 50th between 8th & 9th Ave.	32.0	**19.3**	3.3	2.2	3.7	2.3	3.4	2.2	3.3	2.2	3.3	2.2
15 11th Ave. between 52nd & 53rd	**61.2**	**31.7**	11.0	5.0	8.9	4.4	10.6	4.8	10.5	4.7	10.4	4.9
16 Canal between Church & Mercer	**42.1**	**15.9**	14.2	7.3	12.6	6.3	12.0	6.3	11.9	6.3	11.5	6.0
Standards(c)	35.	9.	35.	9.	35.	9.	35.	9.	35.	9.	35.	9.

(a) Predicted for 1972; all others for 1995.

(b) Predicted concentrations calculated at curb line.

(c) Concentrations exceeding National Ambient Air Quality Standards shown in bold type.

(It has been assumed in this analysis that there is no change in geometry and therefore in the dispersion characteristics at any site between 1972 and 1995.) The results shown in Table 62 reflect the ability of each of the different alternatives considered to divert traffic and, again in particular, trucks, from the local streets to the highway or highway corridors.

The Maintenance alternative would not cause any truck diversion from the local streets. Consequently, truck volumes on the local streets are large and the highest pollutant concentrations were obtained for this alternative.

Both the Arterial and Reconstruction alternatives provide facilities for trucks in the highway corridor. Consequently, these two alternatives result in some diversion of truck trips away from the secondary impact area to the highway corridor. Lower concentrations were predicted using these two alternatives than were obtained for the Maintenance alternative.

The Inboard and Outboard alternatives provide a new highway with a high level of service for trucks and autos, and consequently produce the maximum diversion of trips from the local streets to the highway corridor. The result is that traffic volumes in the secondary impact area for these two alternatives are lower than these obtained for any of the other three alternatives, with some exceptions. The 16 secondary area sites examined generally had the lowest carbon monoxide concentrations for these two alternatives.

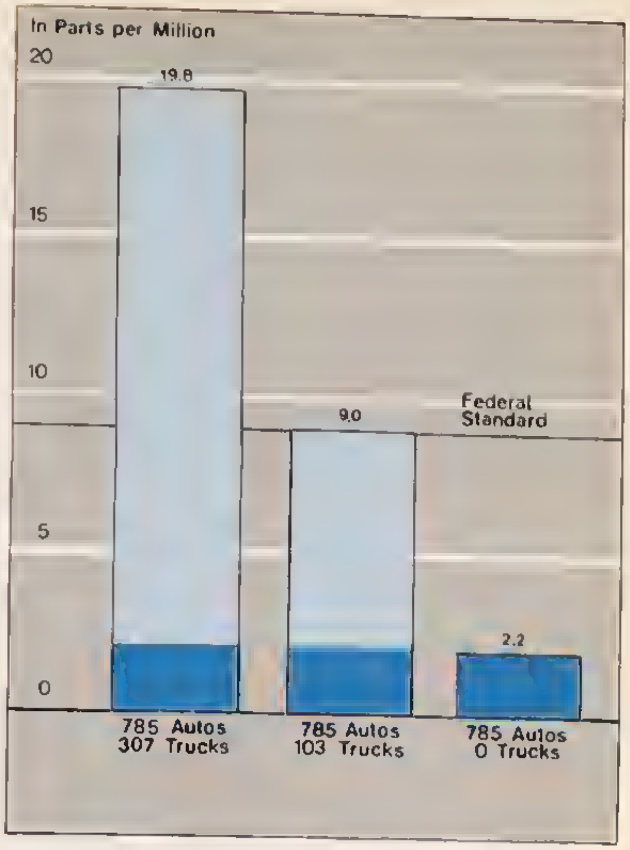

Illustration 99 Eight-Hour Carbon Monoxide Concentrations in Secondary Impact Area in 1995

🟦 Automobile Carbon Monoxide Emissions

⬜ Truck Carbon Monoxide Emissions

Tunnel Areas

As discussed in the description of methodology, the tunnel areas were subject to a comparative air quality analysis involving calculation of the vehicle miles traveled in 1995 in the two quarter-mile square areas containing the Holland Tunnel portals, and the two quarter-mile square areas containing the Lincoln Tunnel portals. Tables 63 and 64 show the vehicle miles traveled and the quantities of carbon monoxide that would be emitted from mobile sources around the tunnel areas for each of the Project alternatives.

In reading these tables, it should be kept in mind that the number of vehicle trips made through these tunnels is the same for all alternatives, because the trip table used to generate these vehicle miles traveled is the same for all alternatives. Any change in the vehicle miles traveled in the vicinity of the tunnels implies, therefore, a change not in the traffic volume through the tunnel, but a change in the through trips that use local streets. In general, the quantity of pollutants emitted in an area depends on two parameters—the average vehicle speed, and the vehicle miles traveled. For a given average vehicle speed, an increase in vehicle miles traveled will cause a concomitant increase in pollution. A decrease in vehicle miles traveled will, conversely, cause a decrease in pollution. For a given traffic volume or vehicle miles traveled, the amount of carbon monoxide emitted is inversely proportional to average vehicle speed—the higher the speed, the smaller the quantity of carbon monoxide emitted.

Consequently, in areas with complex traffic patterns, such as those around the Holland and Lincoln Tunnels, it is possible to decrease pollutants and at the same time meet the demand for trips in two ways. First, the average speed of traffic in the area can be increased by improving the flow of vehicles into and out of the area. Second, the vehicle miles traveled through the area can be decreased by providing alternative means of moving around the area. The second method also results in increased average speeds for vehicles in the area.

The two interstate alternatives, with their direct connections between a new highway and the two tunnels, would provide such traffic improvement. The average vehicle speed would be increased through the trip diversion opportunity created by the new connections. These traffic improvements would decrease the carbon monoxide emissions in the area and improve air quality.

Table 63 **Comparison of Vehicle Miles Travelled in the Vicinity of the Holland and Lincoln Tunnel Portals in 1995**

Holland Tunnel	Maintenance		Reconstruction		Arterial		Inboard		Outboard	
	Auto	**Truck**	**Auto**	**Truck**	**Auto**	**Truck**	**Auto**	**Truck**	**Auto**	**Truck**
A.M. Peak Hour	5,131	1,090	5,111	981	4,841	966	4,658	960	4,278	962
P.M. Peak Hour	6,703	653	6,804	584	6,425	597	6.121	584	6.091	585
Lincoln Tunnel										
A.M. Peak Hour	6,977	1,022	6,641	893	6,799	921	6,411	979	6,581	987
P.M. Peak Hour	7,240	673	7,198	638	7,141	639	7,008	677	6,926	676

Table 64 **Quantities of Carbon Monoxide Emitted from Mobile Sources in the Vicinity of the Holland and Lincoln Tunnels in 1995**
All values in pounds per hour

Holland Tunnel	Maintenance	Reconstruction	Arterial	Inboard	Outboard
A.M. Peak Hour	399	360	360	343	338
P.M. Peak Hour	323	298	296	275	278
Lincoln Tunnel					
A.M. Peak Hour	366	343	337	344	348
P.M. Peak Hour	279	265	266	262	261

Comparison An examination of Tables 63 and 64 indicates that the Inboard and Outboard would each have lower vehicle miles traveled and lower carbon monoxide emissions than any of the other alternatives. The single exception to this fact is the morning peak hour values at the Lincoln Tunnel. Local traffic for the interstate alternatives would not result in the lowest number of vehicle miles traveled. In general, the improvement in traffic flow around the tunnel areas obtained with either the Inboard or Outboard alternatives would improve the air quality in these areas over the other alternatives, through a reduction in carbon monoxide emissions.

Ventilation Buildings

The ventilation buildings analysis indicates that National Ambient Air Quality Standards for carbon monoxide and for particulates would not be violated by emissions from any of the ventilation buildings. This result would occur because the buildings have been designed to avoid any violation of standards. Building location, stack heights, duct sizes, fan sizes, air flow rates and other vent building characteristics were all selected to insure that the standards would be met.

New York Air Quality Plan

As mandated by the Federal-Aid Highway Act of 1970, any highway to be built using Federal funds must be consistent with an approved plan for the implementation of National Ambient Air Quality Standards for the appropriate air quality control region.[68] In the case of this Project, a selected alternative would have to be consistent with the **New York City Metropolitan Area Air Quality Implementation Plan Transportation Controls,** dated April 1973. As the following discussion will show, the West Side Highway Project alternative proposals are consistent with this New York Air Quality Plan.

The question of consistency of a proposed transportation facility with an air quality plan may be separated into two parts:

- Would the proposed facility contribute to the overall objectives of the plan—that is, would it contribute to the reduction of pollution and the achievement and maintenance of National Ambient Air Quality Standards?

- Would the proposed facility contribute to the successful achievement of the specific implementation strategies presented in the plan?

Consistency with Plan Objectives

The introduction to the New York Air Quality Plan clearly states its objectives:

> In this **plan are set forth the transportation control measures that have been developed to** *reduce emissions of these mobile source pollutants and restore* ***healthful air quality to the region.*** **Adherence to the full course of action prescribed herein, particularly the long-range transit improvement strategies, will assure not only achievement of the standards by 1975, but maintenance of air quality meeting primary standards for the foreseeable future.** (Emphasis added.)[69]

As discussed in the air quality portion of Section 2, no simple statement claiming either that all highways increase or that all highways decrease urban air pollution is correct. Each case must be examined with particular attention to the relationship of an alternative to two significant factors—the generation of traffic, and the change in traffic flow. If the alternative is a major trip generator by its very existence, it will tend to increase air pollution. Each of these effects must be measured against a specific alternative that would be present if the particular highway facility were not in operation.

An alternative which would simply replace the existing West Side Highway cannot by itself be considered a trip generator. The present and future land uses in the Manhattan Central Business District (CBD) are principally responsible for trips made on the highway and street system. Person trips can be made by transit, private auto and taxi—with costs, comfort, convenience and other factors playing a determining role, unless a deliberate policy is adopted to constrain choices.

In order to provide such a constraint on trips to be made by auto, the City of New York has proposed a policy of limiting parking spaces in the CBD.[70] In response to this policy, the Project transportation studies considered parking availability as a major constraint on auto usage. An analysis of parking availability was used as a major factor for the forecast of 1995 trips, as discussed in the transportation and travel impacts section.

A separate analysis was made to determine whether any of the alternatives would significantly affect trips going through the CBD without having an intermediate destination—through trips. Preliminary analysis indicated that the Maintenance, Reconstruction and Arterial alternatives would offer no advantages to through trip movements. The Inboard and Outboard alternatives would have no significant effect—less than one percent—on the attraction of auto and truck through trips, but would have a significant effect on the distribution of such trips on the Manhattan highway and street network. About six percent of the truck through trips and about eight percent of the auto trips through the Lincoln and Holland Tunnels, which otherwise would use local streets to and from the East River crossings, would instead use the Inboard or Outboard alternatives for trips to the Brooklyn-Battery Tunnel.[71]

Each of the alternatives would have a different effect, in varying degrees, on probable future land uses in the West Side Study Corridor, as discussed in the section on social and economic impacts. Because of the extensive street and transit networks, factors other than the availability of a highway, including City policy, land and development economics and the forces of competition are the dominant influences on development in New York. Both the quantity and quality of available transportation do influence land-use decisions in New York, but to a lesser degree than in many other cities. In the absence of an officially approved City policy on development of the West Side, no definitive statements can be made beyond the probable influences of each alternative.

Consistency with Implementation Strategies

The air quality implementation strategies are divided into five categories:

A Motor Vehicle Emission Controls
B Traffic Control Policies
C Public Transit Improvements
D Goods Movement Strategies
E Long-Range Implementation Strategies

The strategies have also been grouped according to their immediate or long-range importance in affecting air quality, as follows:

Primary Strategies Essential for compliance with air quality standards by 1975.

Maintenance Strategies Necessary to maintain satisfactory air quality after 1975.

Contingency Strategies To be applied if primary strategies fail.

Secondary Strategies Further analysis is needed before implementation.

Table 65 shows the relationship of each of the five Project alternatives to each of the implementation strategies. An alternative may provide a "positive" contribution to achievement of a strategy, a "negative" constraint on achievement of the strategy, or may be "unrelated" to achievement of the strategy. These relationships for 27 of the 37 specific implementation strategies are shown in the table. This includes all except the ten motor vehicle emission strategies, which are not listed because the alternatives are unrelated to them. The presence or absence of a new highway facility in no way affects the achievement of motor vehicle emission controls. In addition, the Project alternatives are shown to be unrelated to the achievement of 20 of the 27 listed strategies. The remaining seven strategies are related to certain Project alternatives, and are noted accordingly in the table.

Strict Enforcement (Strategy B-1A) None of the Project alternatives would inhibit the strict enforcement of existing traffic regulations in New York City. Therefore, the alternatives are unrelated to this particular strategy.

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[68] **United States Code,** Title 23, Section 109 (j).

[69] **New York City Metropolitan Area Air Quality Implementation Plan Transportation Controls,** New York State Department of Environmental Conservation, April 1973, page 1-1.

[70] **Travel and Traffic Forecasts for 1995,** West Side Highway Project Report No. 5.19, September 1973.

[71] "Through Truck Analysis," Project Memorandum, December 1973.

Traffic Management Four of the traffic management strategies may be grouped together for the purposes of this discussion, because they are all related to the control of traffic through a variety of management techniques. These four strategies include: managing traffic (B-1B); banning private autos from Manhattan (B-2); designating certain cross-town Manhattan streets for through movement only (B-4); and regulating vehicle mix (B-6).

The two alternatives which include an interstate highway facility—Inboard and Outboard—would make a positive contribution to the achievement of some of these traffic management strategies. Because such new facilities would include an extensive and sophisticated traffic control and surveillance system extending onto the local streets, it would make a positive contribution to the attainment of improved management of traffic on the West Side. Through trips could be accommodated, and local trips kept out of the CBD. The operation of the Inboard and Outboard alternatives with only four interchanges between the Brooklyn-Battery and Lincoln Tunnels would greatly enhance the designation of certain cross-town streets for through movement only. Such a traffic control and surveillance system could be used to provide a rational method for the channeling of certain cross-town traffic to the designated through movement arteries. The system as developed for the Inboard and Outboard alternatives could also be used to regulate vehicle mix through the separation of passenger movement from goods movement—that is, cars from trucks. It would be possible to use the traffic control and surveillance system to separate cars and trucks into exclusive lanes, both on the mainline and the ramps.

The Reconstruction and Arterial alternatives would also provide an opportunity for traffic management, as it would be possible to develop a traffic surveillance and control system for these two proposals. Both the Reconstruction and the Arterial would have surveillance and control systems, but would not assist in controlling through traffic on some cross-town streets to the extent that would be possible with the Inboard and Outboard. The Reconstruction alternative has few interchanges, but all connect to West Street-Twelfth Avenue, which connects to all local streets. The Arterial alternative connects at grade with most cross streets.

The Maintenance alternative must be considered as unrelated to the traffic management strategies, which could be implemented without control and surveillance on the West Side Highway. The Maintenance has ramp connections to West Street-Twelfth Avenue similar to the Reconstruction alternative, and would have limited effect on the designation of cross-town streets as major through movement arteries.

Ban on Taxi Cruising (B-1C) Taxi cruising is unrelated to the West Side Highway. The existence and operation of any of the alternatives would not inhibit the successful implementation of this strategy.

Reduced CBD Parking (B-3) The existence and operation of any of the alternatives would not inhibit the successful implementation of this strategy. All alternatives must therefore be considered unrelated to this strategy.

Exclusive Bus Lanes and Increased Bus Service (B-5) The Inboard, Outboard and Arterial alternatives all include some form of transit. Particular emphasis has been given to the use of controlled bus lanes or rail transit on the Arterial, and to exclusive bus lanes or rail transit on the Inboard and Outboard. These three alternatives would, therefore, make a positive contribution to the achievement of this strategy. Because Maintenance and Reconstruction alternatives make no provision for exclusive bus lanes, they are unrelated to this strategy.

Tolls on East and Harlem River Bridges (B-7) The existence and operation of any of the alternatives would not inhibit this strategy. Tolls may be placed on the East and Harlem River bridges whether or not a particular Project alternative is implemented.

Marketing Public Transit (C-1) The Arterial, Inboard and Outboard would provide an enhancement for this strategy, because they would be developed with mass transit as an integral component of the transportation facilities to be constructed on the West Side.

Transit Timetable and Fare Changes The four strategies that may be grouped in this category are: transit timetable simplification (C-2); reduced or free transit fares (C-3); advanced transit fare payment (C-4); and reciprocal transit fare arrangements (C-5). None of the Project alternatives would have any effect on the achievement of changes in transit timetables or fare structures.

Bus and Subway Integration (C-6) The Arterial, Inboard and Outboard alternatives would enhance this strategy, because they each provide new transit service tied into the local street network, either through the ramps in the Inboard and Outboard, or directly on the street in the Arterial. In addition, the possibility of putting rail transit under the Arterial, and bus or rail transit in a preferred right-of-way on the Arterial would serve to enhance this strategy. The Maintenance and Reconstruction proposals are unrelated to this strategy because they provide no transit facilities.

Transit System Rehabilitaton (C-7) None of the Project alternatives would inhibit the achievement of this strategy.

Staggered Work Hours (C-8) None of the Project alternatives is related to the implementation of this strategy.

Trucking Strategies Four specific implementation strategies are related to the movement of trucks in Manhattan: consolidation of trucking activities (D-1), improvement in goods movement technology (D-2); after-hours truck deliveries (D-3); and provision of off-street loading facilities (D-4).

The alternatives appear to be unrelated to the specific trucking strategies that have been proposed in the Air Quality Plan. The Inboard and Outboard alternatives provide incentives for the redevelopment of the West Side that would reinforce the strategy of consolidating truck facilities in the area.

Rail Commodity Transport (D-5) All of the alternatives appear to be unrelated to the use of rail for commodity transport.

Development of Waterfront Facilities (D-6) The development of a completely new transportation facility for the West Side of Manhattan represents, at this time, the only feasible catalyst to spur the redevelopment of that area. The existence of a facility carrying trucks would be a major and necessary contribution to the implementation of this strategy. This strategy would almost certainly be impossible without the development of a new facility that carried trucks.

Table 65 Relationship of West Side Highway Project to Air Quality Implementation Strategies

Contribution of Alternatives to Achievement of Strategies, Positive, Negative or Unrelated

Strategy Types		Maintenance	Reconstruction	Arterial	Inboard	Outboard
A. Ten Motor Vehicle Emission Controls (a)		Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
B. Traffic Control Strategies						
B-1A	Strict Enforcement of Existing Traffic Regulations in NYC (a)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
B-1B	Traffic Management (a)	Unrelated	Positive	Positive	Positive	Positive
B-1C	Selective Ban on Taxi Cruising (a)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
B-2	Banning of private autos from Manhattan CBD (c)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
B-3	Reduction in CBD parking spaces (a)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
B-4	Designation of certain crosstown streets in Manhattan for through movement only (d)	Negative	Negative	Positive	Positive	Negative
B-5	Expand use of exclusive bus lanes and increased bus service (a)	Unrelated	Unrelated	Positive	Positive	Positive
B-6	Regulating vehicle mix (d)	Unrelated	Positive	Positive	Positive	Positive
B-7	Imposition of tolls on all East River and Harlem River bridges (a)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
C. Public Improvement Strategies						
C-1	Marketing public transit system (b)	Negative	Negative	Positive	Positive	Positive
C-2	Transit timetable simplification (d)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
C-3	Reduced or free transit fares (d)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
C-4	Advanced transit fare payment (d)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
C-5	Reciprocal transit fare arrangements (d)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
C-6	Integration of Bus and subway systems (b)	Unrelated	Unrelated	Positive	Positive	Positive
C-7	Transit system rehabilitation (b)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
C-8	Staggered work hours (a)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
D. Goods Movement Strategies						
D-1	Consolidation of trucking activities (b)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
D-2	Improvements in goods movement technology (b)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
D-3	After hours truck deliveries (a)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
D-4	Provision of off-street loading facilities (b)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
D-5	Use of rail for commodity transport (d)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
D-6	Development of waterfront facilities (b)	Negative	Unrelated	Positive	Positive	Unrelated
E. Long Range Implementation Strategies						
E-1	Spur research in urban and transportation planning (b)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
E-2	Special truck demonstration (b)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
E-3	Land use policies and development control (b)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated
E-4	Citizen participation (a)	Unrelated	Unrelated	Unrelated	Unrelated	Unrelated

(a) Primary strategy—essential for compliance with air quality standards by 1975

(b) Maintenance strategy—necessary to maintain satisfactory air quality after 1975

(c) Contingency strategy—applied if primary strategies fail

(d) Secondary strategy—further analysis needed before implementation

Long-Range Strategies The strategies developed for consideration over the years from the present through and beyond 1975 include the following: research in urban transportation planning (E-1); special truck demonstration (E-2); land-use policies and development control (E-3); and citizen participation (E-4).

With the exception of E-3, the long-range strategies appear to be unrelated to any of the Project alternatives Research and development programs can be carried on without regard to the existence and operation of a highway on the West Side. Strategy E-3, which involves the creation of restrictive land-use policies and development controls, has some relation to a highway in the area. The creation of a major new transportation facility on the West Side would influence land use in the area It is not possible at this time to speculate whether such development would take place, and the final answer to this question is subject to City development policies. In those instances where new land use would develop because of a transportation facility incentive, and where City Policy would permit such development, this combination could serve to inhibit the achievement of this strategy.

With the exception of strategy E-3, it is clear that the Inboard and Outboard alternatives would make either a positive contribution to the successful implementation of the strategies, or are unrelated to them. In some cases, the existence of a new transportation facility would make a major contribution to the successful implementation of the strategies, and might be the most Important element in the implementation of two specific strategies.

The Arterial alternative would provide a clear inhibiting influence on only one of the strategies, and serve to enhance a number of others. The Reconstruction alternative would provide numerous opportunities for enhancement of the strategies, but would also inhibit other strategies. In particular, rehabilitation of the existing West Side Highway would do little to improve the transit situation on the West Side, and would do nothing to provide an improvement to the deteriorated West Side environment.

The Maintenance alternative must be considered as generally unrelated to the Air Quality Plan, except for the specific strategies that would be Inhibited by simply maintaining the existing structure.

National Ambient Air Quality Standards

The Project air quality study was undertaken in order to determine the probable Impacts of the five alternative proposals on air quality in the New York Region and in the West Side Study Corridor. Analyses were made of potential effects on air quality in the Region, the primary impact area, the secondary impact area, the tunnel areas and areas affected by the ventilation buildings. The regional studies involved the analysis of hydrocarbon and nitrogen oxide emissions, and a comparison of these emissions between the West Side impact area and the Region.

The primary and secondary area analyses included a pollutant measurement program, the development, calibration and operation of mathematical models to determine pollutant concentrations in these areas, the comparison of pollutant concentrations with National Ambient Air Quality Standards, and the comparison of impacts among the alternatives. The tunnel area study involved an analysis of the vehicle miles traveled and the pollutant emissions in the areas around the Lincoln and Holland Tunnels. Vehicle miles traveled and pollutant emissions were compared among the alternatives. The ventilation building analysis involved the calculation of pollutant concentrations resulting from emissions from the proposed ventilation buildings.

The results of these analyses clearly indicate that the Inboard and Outboard alignments, with their interstate highway facilities and associated collector-distributor roads, would provide the greatest opportunity among all the alternatives for the improvement of air quality in both the impact corridor and local neighborhoods. Pollution concentrations adjacent to the highway corridor and in the local neighborhoods would generally be lower if these alternatives were implemented than if any of the other proposals were chosen.

A number of general comments can be made from all of these studies and from a study of the Air Quality Plan. In performing such analyses, it is necessary to examine in detail the transportation demands and the resulting traffic at every location where air quality is to be analyzed. As a result, considerable insight into the relationship between traffic and air pollution is gained. A principal conclusion of these studies is that the problem of truck traffic and truck pollutant emissions should be a matter of serious concern to air quality agencies, both at the Federal level and at the City and State levels in New York. Throughout this report, an attempt has been made to display with numerical examples the severity of this problem, particularly in relation to the high pollutant emissions from trucks compared to the relatively low emissions from automobiles expected in 1995. Each gasoline truck in 1995 will emit as much carbon monoxide as about 42.5 automobiles. This means that on those streets in 1995 that have large truck volumes, there may be an air pollution problem regardless of the stringent emission controls that have been placed on automobile emissions. This fact bears particular relation to the Air Quality Plan.

The Air Quality Plan makes no specific determination on how specific strategies would be effected, which would actually be used, which might be abandoned, or what the specific timetable would be for determining the effectiveness of the strategies. The New York City Department of Air Resources has stated that the strategies might change over time, as compliance with the National Ambient Air Quality Standards is or is not achieved with the application of specific strategies. Thus, it is not possible to determine at this time whether any specific strategy would be in force when one of the Project proposals were put into operation. In particular, it is impossible to predict what strategies might be in force in 1995, when it it presumed that maintenance of air quality will be a routine and well-enforced City policy. It is possible, however, in light of the extensive analyses performed for this Project, to suggest those strategies that would best serve to maintain air quality standards in New York.

In particular, it is recommended that the City attempt to implement those strategies that serve to improve goods movement in New York. These strategies, designated in the Air Quality Plan as D-1 through D-5, include the consolidation of trucking activities, improvements in goods movement technology, after-hours truck delivery, provision of off-street loading facilities, and the use of rail for commodity transport. The after-hours truck delivery strategy appears to have important consequences for the improvement of New York City air quality in 1995. A numerical example of the improvement that could be made in the air quality on a local street in Manhattan if trucks were partially or completely removed shows that automobiles will contribute little to local street air pollution in 1995, and that even if all automobiles were removed from the streets, trucks would still create a pollution problem and would violate National Ambient Air Quality Standards.

The studies presented in this Environmental Impact Statement have in themselves made an important contribution to the improvement of air quality in New York. The provision of extensive air quality measurement data, the analysis of the relationship between Manhattan traffic and air quality, and the development of a conceptual understanding of the most important problems to be solved in improving New York air quality have all been products of the West Side Highway Project, and are now available to the cognizant air quality control agencies at both City and State levels.

State of New York Comments

In accordance with Federal Highway Administration regulations, comments on the consistency of the Project with the Air Quality Implementation Plan were requested from the designated air pollution control agency. In New York, this agency is the New York State Department of Environmental Conservation. After a review of this air quality impacts section of the Environmental Impact Statement, the head of that department submitted the following comments:

My staff has reviewed the preliminary West Side Highway Project Environmental Impact Statement submitted to me in conformance with the requirements of Section 770.204 (3) (b) (iii) of the Code of Federal Regulations (Air Quality Guidelines for Use in Federal Aid Highway Programs).

The Federally approved Air Quality Implementation Plan for transportation sources in the New York Metropolitan Air Quality Control Region sets certain goals and procedures for achieving these goals.

Based upon review of the above document and a series of meetings held with your staff and the Project consultants, and contingent upon verifications as indicated below, I made the following tentative findings regarding the substantive statements, conclusions and assumptions included in the document.

1. Considering the maintenance of the current Highway as a baseline for air quality impact, the Inboard and Outboard alternatives would be consistent with the Plan, and generally enhance ability to achieve and maintain air quality standards. The Reconstruction and Arterial alternatives would have a varying impact on air quality and implementation strategies, with overall impact being negative.

2. As stated in the preliminary draft, emissions of hydrocarbons and oxides of nitrogen are not expected to significantly change air quality for applicable standards in the Region.

3. As indicated in the document, it appears that attainment and maintenance of carbon monoxide standards will depend upon instituting requirements for reductions in allowable gasoline powered truck emissions regardless of the configuration of the West Side Highway.

The following supportive or clarifying Information must be submitted to this Department sufficiently in advance of the planned public hearing to allow for verification of the above tentative findings:

A. Supporting technical data demonstrating that the 1995 conditions selected for analysis are representative of the period of most significant impact, as contrasted with conditions expected during the first year of operation and at five-year intervals thereafter.

B. Supporting information on the determination that there will be no increased trip generation because of the Project.

C. The revised environmental statement must contain assurances of the integrity of express bus lanes, subways and other rail facilities in the various alternatives.

D. Supporting information on the relationship of each alternative to the development of off-highway traffic control systems and designations, including estimates of the effect on VMT and traffic speed, should be submitted.

The following specific data will be required for A and B above:

1. Predictions of carbon monoxide air quality in the secondary impact area during the first year of operation of all the highway alternatives, using:

a. Most recently published Federal techniques with specific modifications for New York City acceptable to this Department.

b. Assumptions in the approved SIP relating to VMT reductions, flow improvements and gasoline truck controls.

2. Specific references supporting the statement that the highway has no direct effect on carbon monoxide concentrations outside a 50 to 100 foot corridor, that the highest concentrations in street canyons are for parallel winds, and that plug-flow on the highway need not be considered.

3. Submission of the Air Quality Technical Report, showing calibrations and verifications used in the modeling processes for all considerations.

a. Submission of an origin-destination analysis of trips within the Region, with specific emphasis on those using the highway.

b. Analysis of the change in trip patterns in Manhattan by class of vehicle, both with and without the highway.

c. Analysis of the change in emissions in the CBD under the various construction alternatives.

I look forward to a continuing exchange of information and dialogue on this significant project, leading to appropriate final findings.

The Project staff will continue to consult with the New York State Department of Environmental Conservation in order to supply data and Information which will respond to written comments. Specifically, the staff will meet with Environmental Conservation personnel to work out the most informative way to supply information needed by the Department.

Summary

The Inboard and Outboard proposals, which include a new interstate facility, appear to be entirely consistent with the **Transportation Controls** of the **New York City Metropolitan Area Air Quality Implementation Plan.** They appear to satisfy the requirements of the Federal-Aid Highway Act, and the administrative mandates of the Federal Highway Administration.

The Arterial alternative is less consistent with the Air Quality Plan, although it would provide some important enhancements to the strategies. Finally, the Maintenance and Reconstruction alternatives are far less consistent with the plan.

Impacts on Noise Levels

The Policy Statements of the Steering Committee reflect the concern of the City and the West Side communities with improving the quality of the physical environment in Manhattan and on the West Side. The following statements indicate their concern with noise levels:

- **Assure that the Project design reflects compliance with appropriate Federal, State and local noise environmental standards and additionally that such standards are adhered to during construction.**

- **Incorporate appropriate noise pollution control devices and design features in the physical plant of the highway.**

- **Investigate and evaluate the extent to which alternatives reduce the pollution from transportation sources on the West Side Highway and in the adjacent communities.**

The Project study has been conducted in compliance with Federal Highway Administration (FHWA) guidelines. In some instances, the analysis has gone beyond these requirements so that a better understanding of traffic-related noise within the Study Corridor could be gained. Certain design features have been considered in light of their ability to effect noise reductions at specific locations, and evaluated in terms of feasibility and the amount of reduction which they would provide. For descriptions of existing noise conditions and measurement practices, the reader is referred to Section 2 of this Statement.

Methodology

The calculation method used to predict 1995 noise was developed by the Transportation Systems Center of the United States Department of Transportation. Where this method was not applicable, as with stop-and-go traffic, and for noise progression along local streets and around corners, the method was extended through measurements made as part of the Project noise study, supplemented by applicable technical literature. Specifically, noise emissions of several hundred trucks and buses were measured on New York City streets to allow extension of the model to very low speeds. Medium trucks—the "New York vans," with two wheels on the front axle and four wheels on the rear axle—were measured separately because of the large numbers of such vehicles operating within the City. In addition, the effects of cobblestone pavements and stop-and-go traffic were measured, and noise channeling down side streets determined.

The resulting Project methodology employed the Transportation Systems Center noise model, extended by Project measurements, to determine the close-by noise levels in units of dBA L_{10}. These levels depend upon the traffic volume, speed and mix between heavy trucks, medium trucks, buses and automobiles, as well as distance from the traffic, the existence of walls behind the receiver and pavement roughness. The calculations are very insensitive to changes in traffic volumes. For example, it would take a doubling of the truck volume, where trucks dominate the noise, to produce a 3 dB change in the noise level. Such a noise level change is barely discernible by a human observer. To produce a significant change of 5 dB, the traffic volume of the dominant vehicle must change by a factor of 3—for example, from 15 to 45 heavy trucks per hour. Similarly, the noise level is insensitive to changes in traffic speed, since trucks and buses dominate the noise throughout the Corridor. For these vehicles, a tripling of the speed is needed to produce a 5 dB reduction.

The Bayview Rehabilitation Center in the Chelsea community was one of the sensitive institutional land-use sites in the Project noise study

The calculations started with the morning and afternoon peak-hour volumes for automobiles, trucks and buses, along with the corresponding speeds. These volumes and speeds vary from block to block along West Street-Twelfth Avenue, and from ramp to ramp along the highway. First, the truck volumes were divided between heavy and medium trucks, based upon the actual truck counts made during the noise measurement program. If the peak hours are congested (technically, "Level of Service D" or "E"), then the automobile noise will be artificially low, since slow speeds mean quiet automobiles. The same is not true for trucks, however. For such cases, the loudest possible automobile condition ("Level of Service C") was substituted for the peak-hour automobile conditions. This loudest condition would probably occur just before and just after peak hour. Sometimes this substitution was necessary for just one of the peak hours, sometimes for both. Finally, both the morning peak noise level and the afternoon peak noise level were computed and the louder condition chosen. To complicate matters, the louder time of day may be different for the two sides of the roadway. In fact, it may be different at various distances even on the same side of the roadway. Note that when the traffic is congested at peak hour, and the louder automobile conditions were substituted, the loudest auto and the loudest truck conditions were actually combined, even though they occur at different times of the day. It should be noted that this results in a slight over-estimate of the noise.

As a check on the accuracy of the model, the calculations related above were made for 1972 traffic conditions and compared to the 1972 noise measurements. This comparison showed that the calculations over-estimated the 1972 noise measurements by an average of 1 dB for 70 sites, with a total error range from −8 to +10 dB. Over-estimates occurred at 65 percent of the measurement sites. At the nine sites along West Street-Twelfth Avenue, the total error ranged from 0 to +3 dB. Thus, this check showed that the model errs on the conservative side by a slight over-estimate of 1995 noise levels.

Once noise enters a side street and is confined in a canyon-type area, the Systems Center model no longer applies. Therefore, the Project model was extended, using both relevant information from technical literature and measurements made expressly for this purpose on three streets in the Study Corridor. In the extended model, as noise progresses down a side street flanked by buildings on both sides, three mechanisms influence the noise drop off. First, the noise spreads vertically in the normal manner. This spreading can be thought of as noise energy lost upward, and is the same as for noise passage over unobstructed terrain. Second, the noise is confined horizontally between the buildings that line the street, as it reflects back and forth sideways down the street. Third, whenever the noise reflects from a building face, a small amount is scattered upward and escapes to the sky. The model takes all three phenomena into account. As the noise energy progresses through an intersection in the extended model, it is split three ways—straight ahead, right turn and left turn. The splitting depends upon the configuration of the intersection and also upon the directional characteristics of the noise energy when it enters the intersection. Generally, more energy progresses straight through than turns the corners.

No experimental verification has been attempted down side streets and around corners. It is believed that the model predicts more noise energy down the side streets than would actually be measured, due to conservative estimates made during development of the model. The technical reports on noise should be consulted for further details on prediction methodology.

Assessing Noise Impacts

After the 1995 noise was predicted for each alternative, its impact was assessed. Each alternative was compared with the Federal Highway Administration Design Noise Levels to assess the noise on an absolute basis. These Design Noise Levels are discussed in detail below. Each alternative was also compared with the measured 1972 conditions, to determine the change in noise expected from its implementation. Last, each alternative was compared with the others, using the Design Noise Levels as the basic yardstick. Existing-vehicle noise emission levels were used in the first two comparisons and future-vehicle emission levels for the third.

Noise Emission Levels

Noise emission levels are a measure of the noise output of a single vehicle—technically, the highest noise level reached during a vehicle passby at 50 feet. Emission levels used for the mainlines are shown in Illustration 100, where the relative importance of buses and heavy trucks is easily seen. In a stream of traffic, all of the individual vehicle emissions combine in a complex manner to produce the composite, fluctuating traffic noise. If the emission level of every vehicle in the traffic stream dropped by 10 dB, then the entire fluctuating noise pattern would also drop 10 dB. Lacking any Federal schedule for noise emission level reduction, like that which exists for the reduction of air pollutant emissions, expectations are based upon what is now technically feasible, tempered by estimates of future research results. The problem is confined to buses and trucks, which totally dominate both existing and predicted 1995 noise. For these vehicles, two noise sources predominate—engine noise at slow speeds on local streets, and tire noise at high speeds on the mainline highway.

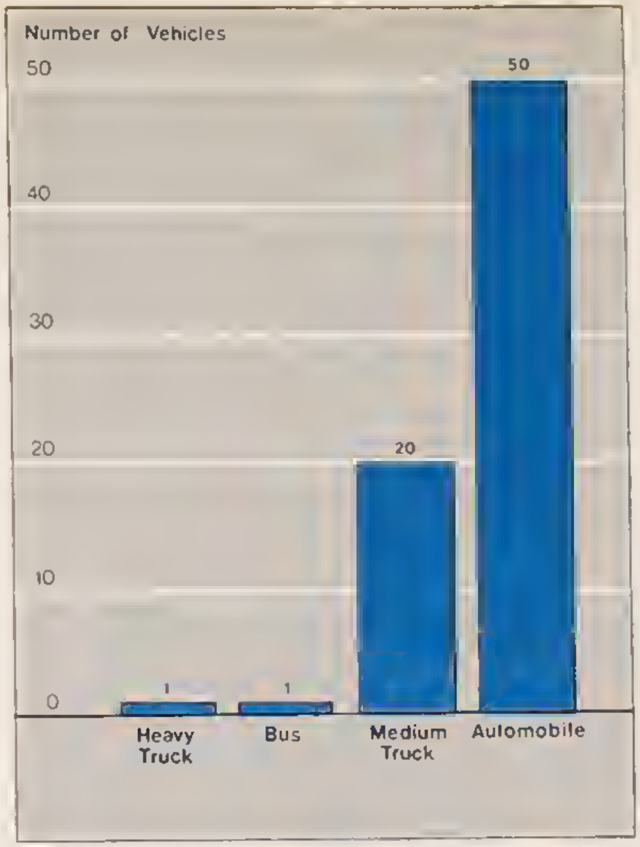

Illustration 100 **Number of Operating Vehicles which Combine to Emit 87 dBA**

For this Project, it has been estimated that in 1995 buses and trucks, traveling at slow speeds, would have emission levels of 70 to 75 dBA. Levels of 75 dBA have been recently demonstrated as both economically and technically feasible, as part of the Department of Transportation Quiet Truck Program. It is assumed that such vehicles, further quieted by some 3 dB, will be in predominant use by 1995. Such trucks and buses are 10 dB quieter than those used in the local street noise model for the Project.

For high-speed trucks, with speeds of 50 miles per hour for alternative highway mainlines, an immediate reduction from 87 dBA to 80-85 dBA could be obtained if the engine were quieted as discussed above, and if the worst types of retreaded tires were eliminated from service. The range in possible reduction results from the type and condition of typical tires in service. Anticipating a trend toward greater use of rib tires instead of cross-bar tires, especially in light of recent indications of relative traction, it is estimated that there would be a 10 dB reduction, from 87 to 77 dBA, for high-speed trucks in service in 1995. The estimate is reinforced by anticipated Federal funding for tire noise research, and by the short life span of truck tires. Beyond this 10 dB reduction, the 1995 engine noise makes further decreases difficult.

In summary, trucks and buses in service in 1995 are expected to be 10 dB quieter than those used in the noise calculations for the Project, both under slow-speed conditions on local city streets, and high-speed conditions on the mainline highway.

These quieter vehicles must be taken into account to realistically compare 1972 noise with 1995 noise. However, these quieter vehicles are not used in the first two comparisons. This is because the FHWA prohibits the use of future truck noise emission levels in making comparisons with its Design Noise Levels. For economic and practical reasons, the Design Noise Levels have been set 10 dB higher than desired; as the vehicles get quieter, it is understood that the Federal Highway Administration intends to lower the Design Noise Levels by a comparable amount, at least for the first 10 dB. The balance between 1995 noise and the Design Noise Levels would therefore remain unchanged, and the assessment would remain the same. In other words, the Design Noise Levels are based upon existing emission levels. In the comparison of noise impacts among alternatives, the balance between alternatives would remain unchanged in 1995 even with the quieter vehicles, since all alternatives would benefit by the same amount. Since the basic yardstick of the comparison among alternatives are these Design Noise Levels, the same 1995 predictions are used for comparison among alternatives as for comparison with the Design Noise Levels.

Design Noise Levels

As discussed above, the FHWA requires that the noise for the loudest hour of the day, after the highway has reached the traffic load for which it was designed, should not exceed the appropriate Design Noise Level. These FHWA Design Noise Levels are based upon the sensitivities of specific types of land use, as shown in Table 66. This table also narrows the FHWA land-use description to specific sites within the Project Study Corridor. As an example, residences planned as part of the Washington Street Urban Renewal Area will have outdoor recreational facilities adjacent to the residential towers. The 70 dBA L_{10} limit (Category B) applies to these recreational areas. The 55 dBA L_{10} limit (Category E) applies to the interior of the residential units themselves. If the windows are operable and normally open in the summer, this interior limit corresponds to an exterior limit of 65 dBA L_{10}. For such residences, a dual Design Noise Level therefore applies—65 and 70 dBA L_{10}.

Table 66 Federal Highway Administration Design Noise Levels

Land Use Category	Design Noise Level (L_{10})	Description of Land Use Category	Specific Application to West Side Highway Project
A	60 dBA (Exterior)	Tracts of land in which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purposes.	No such tracts of land have been designated within the corridor.
B	70 dBA (Exterior).	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas and parks.	Most of the non-industrial land-use within the West Side Highway corridor falls within this category. The first eight land uses listed to the left also fall within land-use category E.
C	75 dBA (Exterior)	Developed lands, properties, or activities not included in categories A and B above.	This category applies only "to outdoor areas which have regular human use and in which a lowered noise level would be of benefit. These design noise level values are to be applied at those points . . . where outdoor activities actually occur." Areas such as "junkyards, industrial areas, railroad yards, parking lots, and storage yards" are specifically excluded. Aside from these excluded areas, the only corridor land uses not included in category B are offices and commercial establishments. Of these, the ones with specific outdoor activities are included here.
D	(see last column)	Undeveloped lands.	The specific requirements of the FHWA for the protection of undeveloped lands (building permit precedes location approval of the highway) are very complex; the FHWA standards should be consulted. In general, undeveloped lands are not protected by the standards. Where development is planned concurrently with the highway design, that land can be considered developed for purposes of the the noise impact evaluation. For the West Side Highway study, the following specific sites are included in category D: Battery Park City Washington Street Urban Renewal Area: Hubert to North Moore Duane to Murray For these sites, the Design Noise Level corresponds to category B, or C, or E, whichever applies.
E	55 dBA (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.	Most of the interior activity within the corridor falls in this category. Where outdoor activity associated with the land use also occurs, then category B above also applies. Otherwise, only category E applies. (This interpretation of the FHWA standards is slightly more protective of the environment than a strict interpretation.) Office spaces have been added to this category for purposes of impact evaluation. The 55 dBA interior level translates to various allowable exterior levels according to the window and ventilation conditions.

Technically, this says nothing about the noise during the remainder of the day. The noise may remain at 65 dBA L_{10} all day long and still satisfy the FHWA requirements. It is anticipated, however, that the hour-to-hour pattern of the noise in 1995 would be similar to the measured pattern of existing noise along West Street. The existing noise remains essentially constant from 8:00 AM to 6:00 PM. During the evening and early morning hours, the noise drops some 5 dB.

During the quietest period of the night, the noise drops another 5 dB. An inventory was made of all noise-sensitive sites that would be exposed by Project alternatives to noise above the FHWA Design Noise Levels. These inventories are displayed below, separately for each alternative.

The Design Noise Levels serve as criteria for rural, suburban and urban areas, without distinction. For urban areas, traffic noise levels from local streets are nearly always above the criteria on their own. The measurements made in 1972 show that Manhattan's West Side is no exception to this rule. For this reason, a second inventory was made of all land uses that are predicted to be exposed above both the Design Noise Levels and the local traffic noise. At these locations, the noise would be controlled by a Project alternative rather than by local street traffic. Under such conditions, noise abatement measures included within the Project design may significantly reduce the noise at the site.

For sites of highly concentrated impact, this secondary inventory incorporates calculations specific to the local streets immediately adjoining the site. For less localized sites, where the impact is spread over many blocks, an average local street noise was used. For example, in one neighborhood, the local street noise ranged from 67 to 72 dBA L_{10} at the building facades, using traffic projections for 1995 consistent with alternative traffic projections. The average street noise was 69 dBA L_{10}. Half of the local streets were noisier than this, and half were quieter. For this neighborhood, the local street noise was uniformly taken to be 69 dBA L_{10}.

The noise of each alternative is compared to the applicable Design Noise Level, site-by-site, to determine the excess impact. Where such excess impact occurs, the FHWA requires either a reduction in the noise, or the justification for an exception to the Design Noise Levels.

There are measures which can reduce the traffic-related noise. For some sites, interior spaces will benefit from sealed windows and air-conditioning. At present, Federal funding is available for such sound-proofing of public or non-public institutional buildings. For other sites, earth ridges or free-standing walls may shield exterior areas at ground elevations. However, such earth berms and walls are not effective for shielding upper stories or in areas where they must be penetrated by cross-streets or pedestrian ways. Other helpful measures include the use of sound-absorbant materials where necessary within covered sections of an alternative to reduce the noise broadcast from the openings in these sections. Detailed provisions for such noise reduction measures would be included in final design of a selected Project proposal. In comparing alternatives, the feasibility of various noise reduction measures will be discussed.

In cases where the noise cannot be reduced to the Design Noise Levels, exceptions to these levels must be requested. Calculations of noise indicate that Design Noise Levels would be exceeded as much as several blocks east of West Street-Twelfth Avenue for all alternatives. However, in many cases, noise from local traffic would actually dominate noise produced by the traffic on the highway or West Street. This was predictable from the results of the 1972 noise measurement program, in which nearly all local traffic noise was above the FHWA limits. In situations where the local street noise would dominate noise produced by an alternative, an exception would be requested, since no actions associated with the Project could significantly reduce the noise. This does not apply along the West Street-Twelfth Avenue itself, or within the first one or two blocks east of the alternative. In those cases, exceptions would be requested only where noise control measures were not feasible for reasons of technology, economy or safety.

Analysis of Alternatives

Comparison with FHWA Standards

For this comparison, noise-sensitive land uses are considered impacted if the predicted 1995 noise levels exceed the FHWA standard for that type of use. The tables showing noise impacts for each alternative are broken down by Community Planning Districts. Within each area, noise-sensitive land uses and activities are noted and the traffic-noise impacts of the alternative are assessed.

Land uses and activities have been divided into three types. The first includes parks, recreation areas, playgrounds and active sports areas, which fall within Land Use Category B of the FHWA Design Noise Levels. Since these are outdoor activities, they are subject to the FHWA standard of 70 dBA L_{10}. In the tables which follow, these areas are referred to as recreational open space. The second type of land use includes hospitals, churches, schools and other institutional uses, as well as hotels and motels. These are referred to as institutional uses. Since they are indoor activities, the FHWA interior standard of 55 dBA L_{10} applies. Noise levels for these types of land use are given in two forms. First, the exterior level is given, and then a corresponding interior level is given. The interior level is determined by allowing for the shielding effect of the building which houses the activity, and more specifically for the window conditions of the building. The third land use considered is residential. Like the institutional uses, residential uses are subject to the 55 dBA L_{10} interior standard, plus the exterior 70 dBA L_{10} standard where there are associated exterior activities.

The concept of speech interference helps to provide an understanding of the effects of different noise levels on an individual's environment. Illustration 101 shows the relationship between noise levels and the outdoor distance at which reliable communication is barely possible.[72] For example, if the noise level were 70 dBA L_{10}, the Design Noise Level for outdoor recreation areas, two persons standing four feet apart could just communicate in raised voices. If the noise level were 5 dBA higher, they would have to move much closer to achieve that communication.

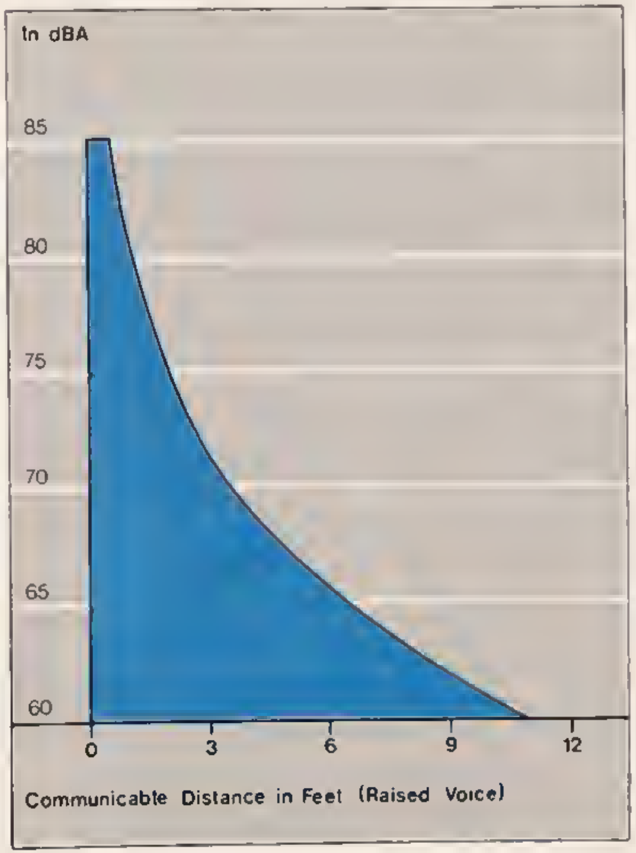

Illustration 101 Distance for Vocal Communication in Relation to Outdoor Noise Level

Illustration 102 presents this concept with regard to indoor communication, assuming the presence of background traffic noise coming through the wall or window. Instead of communication distance in feet, the relationship is given in terms of voice effort. With background traffic noise of 55 dBA, the Design Noise Level for the interior of residences and institutional buildings, conversational tones are possible. Above 70 dBA, a raised voice would be necessary to communicate, and above 75 dBA, the individual would have to speak loudly.

The noise associated with each alternative is presented in tabular form so that predicted noise by land-use type can be assessed more readily. Within each Community Planning District, a number of noise-sensitive locations are listed. These are divided by type of land use in most cases, although in some instances, an institutional use and its associated recreational space are both listed under institutional uses. In Planning Districts Two and Four, residences are scattered throughout. Significant concentrations of residences, such as Westbeth Housing, are identified separately. However, residences which occur along many streets in the West Village and Chelsea areas are too numerous to list separately, nor do they have specific names which make them readily recognizable.

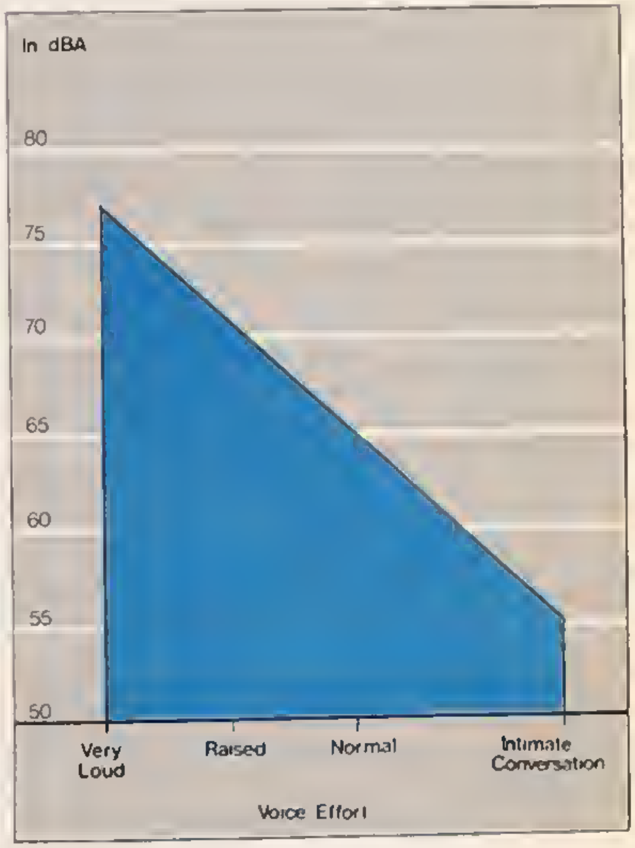

Illustration 102 Voice Effort In Relation to Indoor Noise

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[72] The assumptions used in preparing Illustrations 101 and 102 are that the speaker is male, standing face to face with the listener. The outdoor condition assumes that there are no nearby reflecting surfaces to aid speech sounds. The indoor condition assumes that, beyond three feet, speech signals are boosted by nearby reflecting surfaces.

These residences are grouped in the tables, and the illustrations in the comparison section show these buildings and how they are affected by each alternative.

There are several special cases which require additional explanation or different treatment than the majority of the noise-sensitive sites. The first of these is Battery Park City in Lower Manhattan. Development plans call for approximately 40,000 residents, schools and community centers, and public open space areas. These noise-sensitive land uses will almost certainly be affected to some extent by noise from any of the Project alternatives. However, at this time, the site plan for Battery Park City has not been developed to the point where building and open space locations have been finalized. Thus, it is impossible to assess the impacts of the alternatives, since the sites and types of buildings will determine the amount of noise shielding for open spaces, and these factors are major determinants of noise impact. Therefore, noise levels for each of the alternatives are given only at the eastern property line of Battery Park City. Following selection of one alternative and more definitive building plans for Battery Park City, a complete analysis can be made.

The second case which requires special note is the Washington Street Urban Renewal Area. A portion of the residential development for that area has been completed. At two other sites within the Renewal Area, plans have been prepared, but building has not yet begun. In those cases, the development plans have been used in assessing noise impact for the completed development.

The third case relates to potential development on the landfill included in the Outboard alternative. Portions of the area designated as public park space have been considered in the impact analysis, specifically: the area near the southern entrance to the covered highway section at Houston Street; the area which would serve as a replacement for the Morton Street Pier; the area near West 14th Street; the area which would serve as a replacement for Smith Park; and the area near the northern entrance to the covered section at 27th Street. No plans have been formulated for the developable landfill area between West Street and the park area along the River. Therefore, the particular noise impacts for these areas cannot be determined. A general conclusion, however, is that there would be little or no noise impact from the covered portion of the Outboard, except near portals.

The tables are divided into four main parts. The first columns give the FHWA exterior noise standards, and interior standards where applicable, for each type of use. The FHWA standards are for the nation as a whole and, therefore, do not recognize differences between noise conditions in urban areas and those in suburban and rural areas. The standards are placed first in the table since they define "noise impact"—a predicted noise level above the applicable standard at a given location.

The second part of the tables gives the predicted 1995 noise at each location in units of dBA L_{10}. Here, the exterior levels are shown, sometimes expressed as a range of values. Where applicable, the corresponding interior levels are given, and in those cases, it is the interior level which determines if there is any impact. The difference between the exterior and interior noise level is the amount of noise reduction provided by the building and its windows. The number of noise-sensitive buildings within the study area precluded making actual measurements of noise reduction. In addition, some noise-sensitive buildings are only in the planning stage at present. As a result, average noise reduction values prescribed by the FHWA for the appropriate window type and condition—open or closed—were used.

These values are generally regarded as being conservative. That is, using these values for noise reduction, the tendency would be to under-estimate the reduction and, therefore, over-estimate the amount of noise impact inside the buildings.

However, in one instance, at the Church of Saint Joseph in Lower Manhattan, an outdoor-to-indoor measurement of noise was made. The measurement indicated that the noise was reduced by 19 dB with the doors from the street closed and the windows open—the normal warm weather situation. Although only this site was measured, the measurement is indicative of the conservatism of assuming only a 10 dB reduction in other cases, particularly for residences with relatively small window areas. However, since the reduction factors noted above are those officially prescribed, they were used for remaining buildings. In most cases a 10 dB reduction was used, but a 25 dB reduction factor was used where a survey indicated that year-round air treatment in a building existed, making closed windows possible.

In considering the outdoor-to-indoor noise reduction, the nature of the unit of noise measurement should be kept in mind. A 10 dB increase in the noise level sounds twice as loud, independent of the original level. In the same way, a 10 dB decrease in the level from outside to inside a structure means that the noise inside sounds half as loud as that outside. Illustration 103 shows the reductions in loudness provided by several types of windows and window conditions.

The third part of the tables indicates the noise impacts of the alternatives. The first column indicates the amount of recreational open space or the number of residential dwelling units impacted—the number for which the predicted noise from traffic on each alternative is above the applicable Design Noise Level.

The area of impact for any alternative has as its eastern boundary a line representing the points at which noise levels from the proposed highway and West Street-Twelfth Avenue are predicted to be 65 dBA L_{10}. Thus, the area inside the line (technically, the "65 dBA L_{10} noise contour") represents the total amount of space that would be impacted by an alternative under its loudest traffic-noise conditions.

The second column introduces the important distinction between noise impact directly attributable to a highway alternative and noise which would occur due to local street traffic. Here, residential units and park space for which noise from local street traffic would be higher than noise produced by a new highway and West Street-Twelfth Avenue are subtracted out. In other words, beyond a certain point in any given area, noise from local street traffic would be higher than from a highway mainline and West Street, and local traffic noise would effectively mask the highway noise. Although the residential units and open space areas would still be impacted by being above the FHWA standard, measures to lessen noise from the highway would have little effect in reducing that impact, due to domination of local street noise.

The fourth part of the tables notes the dominant traffic noise source for each impacted site. In every case, the noise source given here relates to the column entitled "Above FHWA Standard." As an example, for the Maintenance alternative, 2,000 residential units are predicted to be impacted by traffic noise from the highway, transitway and West Street. Of these, 960 would have excessive noise levels resulting from traffic on the highway and West Street, and these levels would be higher than noise levels from local traffic. For the remaining 1,040 units, noise levels from local street traffic would be higher. Therefore, the majority of the units would be impacted due to local traffic noise, which is shown as the dominant noise source.

Table 67 FHWA Noise Reduction Factors(a)

Building Type	Window Condition	Noise Reduction Due to Exterior of Structure	Corresponding Highest Exterior Noise Level Which Would Achieve an Interior Design Noise Level of 55 dBA L_{10}
All Types	Open	10 dB	65 dBA
Masonry	Single Glazed—Closed	25 dB(b)	80 dBA

(a) Federal Highway Administration, Policy and Procedure Memorandum 90-2.

(b) This assumes year-round air treatment which allows windows to be closed.

Comparison with Existing Noise Levels
The predicted 1995 noise levels for each Project alternative were also compared to the measured 1972 noise from all sources, as required by FHWA guidelines. This comparison incorporates future vehicle emission levels. Assuming no increases in traffic, the expected reduction in emission levels alone would provide a 10 dB benefit throughout the Corridor. Super-imposed upon this 10 dB decrease are those changes induced by the Project alternatives.

Comparison of 1972 and 1995 noise levels has been made at each of 14 noise measurement sites in the primary impact area. At five sites—Washington Street Urban Renewal Area Site 1, Canal Street between Washington and Greenwich Streets, Washington Street between Christopher and 10th Streets, the Terminal Hotel on 23rd Street, and Eleventh Avenue between 51st and 52nd Streets—the measured 1972 noise was dominated by traffic on streets other than the existing West Side Highway and West Street-Twelfth Avenue. Thus, the comparison of predicted 1995 noise for the Project alternatives with existing noise at these sites would not represent a real change in the noise levels, since local traffic noise sources dominate currently and may continue to dominate in 1995. At the other nine sites, noise from the existing West Side Highway and West Street-Twelfth Avenue dominated the noise in 1972 and would be expected to dominate in 1995. For these sites, the comparison is valid, and the average changes for the Project alternatives, as detailed in the technical report on noise, would be:

Maintenance 8 dB decrease
Reconstruction 5 dB decrease
Arterial 2 dB decrease
Inboard 10 dB decrease
Outboard 11 dB decrease.

Comparison Among Alternatives
In addition to assessing the noise impacts of the individual alternatives, it is also important to compare the relative impacts among them at noise-sensitive locations in the study area. The illustrations and tables which follow provide such comparisons. The material is organized by community planning district, and by land use within each district. Thus, the basic organization is the same as that of the tables of comparison with FHWA standards above, and those tables can be referenced for more complete information on any site or alternative.

The comparisons among alternatives are presented in three ways. Maps have been prepared for each alternative in each of the three Planning Districts. These maps show the alternative alignments, the areas affected by the noise from West Street, the areas affected by noise from the highway and transitway, and the areas in which local street traffic noise dominates noise from the highway and West Street.

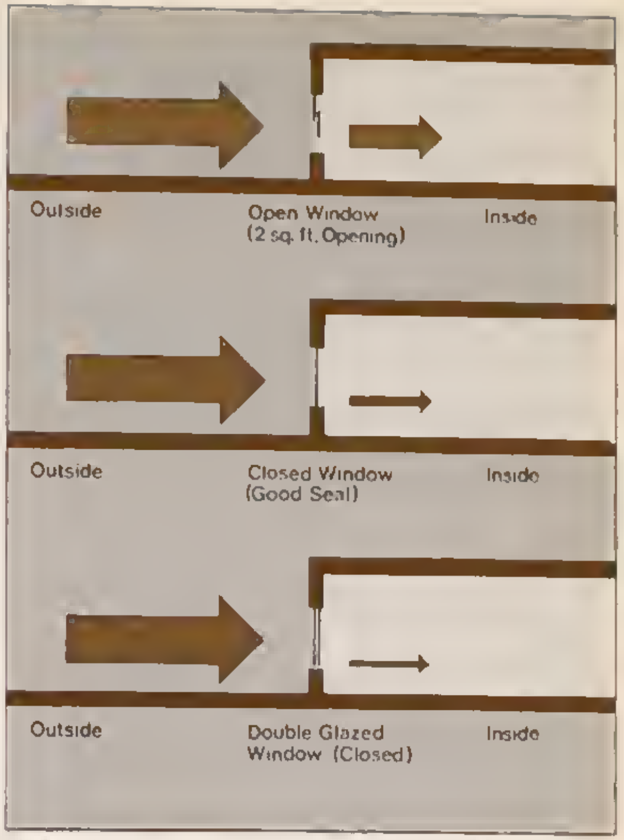

Outside
Open Window (2 sq. ft. Opening)
Inside
Outside
Closed Window (Good Seal)
Inside
Outside
Double Glazed Window (Closed)
Inside

Illustration 103 Outdoor to Indoor Noise Reductions

The noise-sensitive sites impacted by an alternative or by local traffic noise are shown on the maps, and are also shown on a key map with a number for each site. This allows easy reference to the noise impacts presented in the accompanying tables. In several cases, one number is assigned to groups of residences which are scattered throughout a community; these buildings are shown in blue but are not numbered individually.

The tables which accompany these maps indicate the impacts of each alternative at the noise-sensitive sites within the Community Planning Districts. The frame of reference for these impacts is still the FHWA standards; however, the values are expressed as the amount of impact above the applicable standard. For example, a predicted interior level of 65 dBA L_{10} is expressed by the number 10, indicating that the noise level is 10 dBA above the 55 dBA L_{10} standard. Wherever appropriate, values are given as a range. Frequently, noise levels are predicted to range from at or below the standard to above the standard by some amount. In those cases, the impact is given as 0 to 10, indicating that the levels go from at or below the standard to 10 dBA above it. Where no impact is predicted, 0 is entered.

Table 68 Maintenance Alternative

Community Planning District 1	National FHWA Noise Standards Urban, Suburban & Rural		Predicted Noise in 1995 (dBA L_{10})		Amount of Space or Number of Residential Units Impacted		Dominant Traffic Noise Source
	Exterior	Interior	Exterior Level	Corresponding Interior	Above FHWA Standard	Above Standard & Local Traffic Noise	1995
1 Battery Park City	70	55	81-71	(a)	(a)	(a)	
Recreational Open Space							
2 Trinity Place Sitting Areas	70	–	73-67	–	1 Acres (30%)	0 Acres	Brooklyn Battery Tunnel
3 World Trade Center Plaza	70	–	75-65	–	4 Acres (10%)	4 Acres (10%)	West Street
4 Washington St. Urban Renewal Area Plaza	70	–	82-73	–	3.7 Acres (100%)	3.7 Acres (100%)	West Street
Institutional Uses							
5 Church of St. Joseph	–	55	89	70	Yes	Yes	West Street
6 Washington St. Urban Renewal Area Manhattan Community College	–	55	80-73	65-48	No	No	–
7 Washington St. Urban Renewal Area Public School (Site 5)	–	55	76	65	Yes	Yes	West Street
Residential							
Washington St. Urban Renewal Area							
8 Site 5 (Murray to Duane Sts.)	–	55	82-69	72-59	2000 Units	960 Units	Local Traffic
9 Site 3 (Duane to N. Moore Sts.)	–	55	74-64	64-54	1280 Units	610 Units	Local Traffic
10 Site 1 (N. Moore to Hubert Sts.)	–	55	75-60	65-50	310 Units	0 Units	Local Traffic
11 Other Existing Residential Units Impacted	–	55	89-68	79-58	21 Units	1 Unit	Local Traffic
Community Planning District 2							
Recreational Open Space							
12 Morton Street Pier/ Waterside Park	70	–	78-64	–	1 Acres (45%)	1 Acres (45%)	West Street
13 Westbeth Plaza	70	–	76-73	–	.3 Acres (100%)	.3 Acres (100%)	West Street
Institutional Uses							
14 Maritime School Ship, Interior	–	55	–	45-40	No	No	–
Exterior Activities	70	–	70-65	–	No	No	–
15 Keller Abingdon Hotel & Christopher Hotel	–	55	81-75	71-65	Yes	Yes	West Street
16 St. Veronica's Church & School	–	55	Less than 65	Less than 55	No	No	–
17 St. Luke's Church & School	70	55	Less than 65	Less than 55	No	No	–
18 West Hotel	–	55	83-77	73-67	Yes	Yes	West Street
19 Federal Detention Headquarters	–	55	80-69	70-59	Yes	Yes	West Street
20 Hide-a-Way Motel		55	80	70	Yes	Yes	West Street
Residential							
West Village Housing	–	55	81-63	71-53	360 Units	110 Units	Local Traffic
21 Facing West Street	–	55	81	71			West Street
22 On Morton at Washington St.	–	55	70	60			Local Traffic
23 On Washington Street	–	55	63	53			–
Westbeth Housing	–	55	83-63	73-63	330 Units	300 Units	West Street
24 Facing West Street	–	55	83	73			West Street
25 On Bethune at Washington St.	–	55	72	62			West Street
26 On Washington Street	–	55	63	53			–
27 Other Existing Residential Units Impacted from Canal Street to West 14th Street, West Street to Hudson Street	–	55	81-66	71-56	280 Units	70 Units	Local Traffic
Community Planning District 4							
Recreational Open Space							
28 Smith Park	70	–	70-63	–	0 Acres	0 Acres	–
29 DeWitt Clinton Park	70	–	70-58	–	0 Acres	0 Acres	–
Institutional Uses							
30 Bayview Drug Rehabilitation Center	–	55	79-70	69-60	Yes	Yes	West St./12th Ave.
Rooftop Recreational Area	70	–	69	-	No	No	–
31 General Theological Seminary	–	55	Less than 65	Less than 55	No	No	–
32 Guardian Angel Church & School	–	55	Less than 65	Less than 55	No	No	–
33 Terminal Hotel	–	55	Less than 65	Less than 55		No	–
34 Sheraton Motor Inn	–	55	76-65	51-40		No	–
Rooftop Swimming Pool	70	–	62	–		No	–
Residential							
35 Chelsea Residences Existing Chelsea Residential Units Impacted from West 14th Street to West 30th Street, Twelfth Avenue to Ninth Avenue	–	55	67-66	57-56		0 Units	Local Traffic
36 Clinton Residences Existing Clinton Residential Units Impacted from West 34th to West 54th Street	–	55	74-66	64-56	24 Units	24 Units	Mainline Autos

(a) Cannot be Assessed

The Inboard and Outboard alternatives include areas of landfill which have been designated as park space. Since these areas are not common to both alternatives, they cannot be compared. However, they were compared with FHWA standards in the preceding section, and abatement measures to reduce impacts on these open space areas are discussed below.

The next illustration of noise impacts is in the form of cross sections. Four locations, one in each of the communities affected by the alternatives, were selected. At these noise-sensitive sites, buildings and recreational open space areas are shown and the noise levels associated with highway and West Street-Twelfth Avenue are indicated. These sites are the Washington Street Urban Renewal Area in Lower Manhattan, the Morton Street Pier and West Village Housing in Greenwich Village, Bayview Rehabilitation Center in Chelsea, and the Sheraton Motor Inn in Clinton.

The shadings on these illustrations represent 5 dB changes in the noise level—changes which are considered significant. It should be remembered here that a 10 dB decrease sounds half as loud as the original level. Therefore, at a distance two shaded bands away from the initial level, the noise sounds half as loud.

Alternative Interchanges

In addition to the highway mainlines, transitways and West Street-Twelfth Avenue, the Inboard and Outboard alternatives have also been configured with different interchange options at the Holland and Lincoln Tunnels. These interchanges are termed the one-corridor and two-corridor Holland Tunnel interchanges, and the 30th Street corridor and 35th Street corridor Lincoln Tunnel interchanges, as shown in Section 3 of this Statement.

Table 69 Reconstruction Alternative

Community Planning District 1	National FHWA Noise Standards Urban, Suburban & Rural		Predicted Noise in 1995 (dBA L_{10})		Amount of Space or Number of Residential Units Impacted		Dominant Traffic Noise Source
	Exterior	Interior	Exterior Level	Corresponding Interior	Above FHWA Standard	Above Standard & Local Traffic Noise	1995
1 Battery Park City	70	55	86-76	(a)	(a)	(a)	–
Recreational Open Space							
2 Trinity Place Sitting Areas	70	–	72-68	–	1 Acres (30%)	0 Acres	Brooklyn Battery Tunnel
3 World Trade Center Plaza	70	–	70-62	–	0 Acres	0 Acres	
4 Washington St. Urban Renewal Area Plaza	70	–	87-77	–	3.7 Acres (100%)	3.7 Acres (100%)	West Street
Institutional Uses							
5 Church of St. Joseph	–	55	83	64	Yes	Yes	West Street
6 Washington St. Urban Renewal Area Manhattan Community College	–	55	83-82	58-57	Yes	Yes	West Street
7 Washington St. Urban Renewal Area Public School (Site 5)	–	55	80	70	Yes	Yes	West Street
Residential							
Washington St. Urban Renewal Area							
8 Site 5 (Murray to Duane Sts.)	–	55	89-74	79-64	2000 Units	2000 Units	West Street
9 Site 3 (Duane to N. Moore Sts.)	–	55	80-64	70-54	1280 Units	520 Units	Local Traffic
10 Site 1 (N. Moore to Hubert St.)	–	55	73-60	63-50	200 Units	0 Units	Local Traffic
11 Other Existing Residential Units Impacted	–	55	83-67	73-57	30 Units	1 Unit	Local Traffic
Community Planning District 2							
Recreational Open Space							
12 Morton Street Pier/ Waterside Park	70	–	84-71	–	2.3 Acres (100%)	2.3 Acres (100%)	Mainline
13 Westbeth Plaza	70	–	80-77	–	.3 Acres (100%)	.3 Acres (100%)	Mainline
Institutional Uses							
14 Maritime School Ship, Interior	–	55	–	52-47	No	No	–
Exterior Activities	70	–	77-72	–	Yes	Yes	Mainline
15 Keller Abingdon Hotel & Christopher Hotel	–	55	84-78	74-68	Yes	Yes	Mainline
16 St. Veronica's Church & School	–	55	68-66	58-56	Yes	No	Local Traffic
17 St. Luke's Church & School	70	55	Less than 65	Less than 55	No	No	–
18 West Hotel	–	55	83-78	73-68	Yes	Yes	Mainline
19 Federal Detention Headquarters	–	55	83-77	73-67	Yes	Yes	Mainline
20 Hide-a-Way Motel	–	55	83	73	Yes	Yes	Mainline
Residential							
West Village Housing	–	55	84-72	74-62	420 Units	420 Units	Mainline
21 Facing West Street	–	55	84	74			Mainline
22 On Morton at Washington St.	–	55	75	65			Mainline
23 On Washington Street	–	55	72	62			Mainline
Westbeth Housing	–	55	83-71	73-61	343 Units	343 Units	Mainline
24 Facing West Street	–	55	83	73			Mainline
25 On Bethune at Washington St.	–	55	74	64			Mainline
26 On Washington Street	–	55	71	61			Mainline
27 Other Existing Residential Units Impacted from Canal Street to West 14th Street, West Street to Hudson Street	–	55	83-66	73-56	1040 Units	240 Units	Local Traffic
Community Planning District 4							
Recreational Open Space							
28 Smith Park	70	–	72-70	–	2.2 Acres (100%)	0 Acres	Local Traffic
29 DeWitt Clinton Park	70	–	77-65	–	2.8 Acres (45%)	2.8 Acres (45%)	Mainline
Institutional Uses							
30 Bayview Drug Rehabilitation Center	–	55	83-77	73-67	Yes	Yes	Mainline
Rooftop Recreational Area	70	–	76	–	Yes	Yes	Mainline
31 General Theological Seminary	–	55	70-60	60-50	Yes	No	Local Traffic
32 Guardian Angel Church & School	–	55	71-68	61-58	Yes	No	Local Traffic
33 Terminal Hotel	–	55	77-76	67-66	Yes	Yes	Mainline
34 Sheraton Motor Inn	–	55	80-74	55-49	No	No	–
Rooftop Swimming Pool	70	–	69	–	No	No	–
Residential							
35 Chelsea Residences Existing Chelsea Residential Units Impacted from West 14th Street to West 30th Street, Twelfth Avenue to Ninth Avenue	–	55	73-66	63-56	1080 Units	0 Units	Local Traffic
36 Clinton Residences Existing Clinton Residential Units Impacted from West 34th to West 54th Street	–	55	83-66	73-56	90 Units	24 Units	Local Traffic

(a) Cannot be Assessed

There are no differences between the Inboard and Outboard alternatives in terms of the number of sensitive land uses which are noise impacted. Differences do occur, however, for the interchange options. Therefore, the assessment which follows considers only the alternative interchange locations and applies to both the Inboard and Outboard alternatives.

The remaining Project alternatives do not have direct connections to the tunnels, and therefore have not been included in this analysis. However, it should be noted that almost all of the impact from the Inboard and Outboard connections would exist if the existing access ramp configurations were retained at the tunnels.

Table 70 Arterial Alternative

Community Planning District 1	National FHWA Noise Standards Urban, Suburban & Rural		Predicted Noise in 1995 (dBA L_{10})		Amount of Space or Number of Residential Units Impacted		Dominant Traffic Noise Source
	Exterior	Interior	Exterior Level	Corresponding Interior	Above FHWA Standard	Above Standard & Local Traffic Noise	1995
1 Battery Park City	70	55	84-77	(a)	(a)	(a)	–
Recreational Open Space							
2 Trinity Place Sitting Areas	70	–	74-70	–	3 Acres (100%)	0 Acres	Brooklyn Battery Tunnel
3 World Trade Center Plaza	70	–	80-65	–	3.8 Acres (95%)	3.8 Acres (95%)	Mainline
4 Washington St. Urban Renewal Area Plaza	70	–	78-71	–	3.7 Acres (100%)	3.7 Acres (100%)	Mainline
Institutional Uses							
5 Church of St. Joseph	–	55	88	69	Yes	Yes	Mainline
6 Washington St. Urban Renewal Area Manhattan Community College	–	55	82-81	67-66	Yes	Yes	Mainline
7 Washington St. Urban Renewal Area Public School (Site 5)	–	55	74	64	Yes	Yes	Mainline
Residential							
Washington St. Urban Renewal Area							
8 Site 6 (Murray to Duane Sts.)		55	80-67	70-57	2000 Units	2000 Units	Mainline
9 Site 3 (Duane to N. Moore Sts.)	–	55	76-67	68-57	1330 Units	280 Units	Local Traffic
10 Site 1 (N. Moore to Hubert Sts.)	–	55	76-69	68-59	400 Units	60 Units	Local Traffic
11 Other Existing Residential Units Impacted		55	88-68	78-58	21 Units	1 Unit	Local Traffic
Community Planning District 2							
Recreational Open Space							
12 Morton Street Pier/ Waterside Park	70	–	90-76	–	2.3 Acres (100%)	2.3 Acres (100%)	Mainline
13 Westbeth Plaza	70	–	77-73	–	3 Acres (100%)	3 Acres (100%)	Mainline
Institutional Uses							
14 Maritime School Ship, Interior	–	55	–	58-53	Yes	Yes	Mainline
Exterior Activities	70		83-78	–	Yes	Yes	Mainline
15 Keller, Abingdon Hotel & Christopher Hotel		55	85	75	Yes	Yes	Mainline
16 St. Veronica's Church & School		55	74-65	64-55	Yes	Yes	Mainline
17 St. Luke's Church & School	70	55	74-66	64-56	Yes	Yes	Mainline
18 West Hotel		55	81-77	71-67	Yes	Yes	Mainline
19 Federal Detention Headquarters		55	82-75	72-65	Yes	Yes	Mainline
20 Hudson Way Motel	–	55	86	76	Yes	Yes	Mainline
Residential							
West Village Housing	–	55	88-74	78-64	420 Units	370 Units	Mainline
21 Facing West Street	–	55	88	78			Mainline
22 On Morton at Washington St	–	55	80	70			Mainline
23 On Washington Street	–	55	74	64			Mainline
Westbeth Housing	–	55	81-68	71-58	343 Units	325 Units	Mainline
24 Facing West Street	–	55	81	71			Mainline
25 On Bethune at Washington St	–	55	73	63			Mainline
26 On Washington Street	–	55	68	58			Local Traffic
27 Other Existing Residential Units Impacted from Canal Street to West 14th Street, West Street to Hudson Street		55	81-60	71-56	1640 Units	295 Units	Local Traffic
Community Planning District 4							
Recreational Open Space							
28 Smith Park	70	–	76-70		2.2 Acres (100%)	1 Acre (5%)	Local Traffic
29 DeWitt Clinton Park	70	–	80-68		4.5 Acres (76%)	4.5 Acres (75%)	Mainline
Institutional Uses							
30 Bayview Drug Rehabilitation Center	–	55	87-78	77-68	Yes	Yes	Mainline
Rooftop Recreational Area	70	–	80	–	Yes	Yes	Mainline
31 General Theological Seminary	–	55	70-63	60-53	Yes	No	Local Traffic
32 Guardian Angel Church & School	–	55	71-68	61-58	Yes	No	Local Traffic
33 Terminal Hotel	–	55	73	63	Yes	No	Local Traffic
34 Sheraton Motor Inn	–	55	85-80	60-55	Yes	Yes	Mainline
Rooftop Swimming Pool	70	–	75	–	Yes	Yes	Mainline
Residential							
35 Chelsea Residences Existing Chelsea Residential Units Impacted from West 14th Street to West 30th Street, Twelfth Avenue to Ninth Avenue	–	55	74-66	64-56	760 Units	0 Units	Local Traffic
36 Clinton Residences Existing Clinton Residential Units Impacted from West 34th to West 54th Street	–	55	81-68	71-58	170 Units	24 Units	Local Traffic

(a) Cannot be Assessed

Holland Tunnel The impacts of the two-corridor interchange configuration were included in the previous tables on comparisons with FHWA standards. This is because the residential units impacted by the ramp connections are also impacted by noise from the Inboard transitway, and from West Street in the Outboard alternative. The major residential concentration which would be affected is the planned building on Site 1 of the Washington Street Urban Renewal Area; the ramp from the Holland Tunnel to the highway would pass through the northern portion of the site. Although removal of this ramp to another location would not allow the noise standard to be met inside the building, it would reduce the severity of the impact.

The one-corridor interchange would locate both entry and exit ramps to the Holland Tunnel along a Canal Street corridor. As noted, this would benefit residences in the renewal area, but it would cause impact to approximately 150 residences which would not suffer impact from highway-related noise under the two-corridor alternative.

Lincoln Tunnel For the 30th Street corridor interchange, approximately 750 dwelling units would be noise impacted, but only about 300 of those units would be impacted by traffic noise from the ramps. The remaining 450 units would have higher levels due to local traffic noise. The 35th Street corridor interchange ramps would impact 170 units, with 380 additional units impacted by local street noise. However, some of the buildings impacted by the 30th Street corridor would be acquired for the right-of-way of the 35th Street corridor, and thus would not exist for the second interchange option.

Table 71 Inboard Alternative

Community Planning District 1	National FHWA Noise Standards Urban, Suburban & Rural		Predicted Noise in 1995 (dBA L_{10})		Amount of Space or Number of Residential Units Impacted		Dominant Traffic Noise Source
	Exterior	Interior	Exterior Level	Corresponding Interior	Above FHWA Standard	Above Standard & Local Traffic Noise	1995
1 Battery Park City	70	55	80-78	(a)	(a)	(a)	
Recreational Open Space							
2 Trinity Place Sitting Areas	70	–	74-70	–	3 Acres (100%)	0 Acres	Brooklyn Battery Tunnel
3 World Trade Center Plaza	70	–	69-64	–	0 Acres	0 Acres	–
4 Washington St. Urban Renewal Area Plaza	70	–	80-73	–	3.7 Acres (100%)	3.7 Acres (100%)	Transitway
Institutional Uses							
5 Church of St. Joseph	–	55	80	61	Yes	Yes	West Street
6 Washington St. Urban Renewal Area Manhattan Community College	–	55	82	57	Yes	Yes	Transitway
7 Washington St. Urban Renewal Area Public School (Site 5)	–	55	76	66	Yes	Yes	Transitway
Residential							
Washington St. Urban Renewal Area							
8 Site 5 (Murray to Duane Sts.)	–	55	80-72	70-62	2000 Units	2000 Units	Transitway
9 Site 3 (Duane to N. Moore Sts.)	–	55	76-71	66-61	1330 Units	800 Units	Transitway
10 Site 1 (N. Moore to Hubert Sts.)	–	55	78-72	68-62	400 Units	300 Units	Transitway
11 Other Existing Residential Units Impacted	–	55	80-66	70-56	21 Units	1 Unit	Local Traffic
Community Planning District 2							
Recreational Open Space							
12 Morton Street Pier/ Westside Park	70	–	74-61	–	7 Acres (30%)	7 Acres (30%)	West Street
13 Westbeth Plaza	70	–	72-68	–	1 Acres (15%)	1 Acres (15%)	West Street
Institutional Uses							
14 Maritime School Ship, Interior	–	55	–	40-36	No	No	–
Exterior Activities	70	–	65-61	–	No	No	–
15 Keller Abingdon Hotel & Christopher Hotel	–	55	79-72	69-62	Yes	Yes	West Street
16 St. Veronica's Church & School	–	55	Less than 65	Less than 55	No	No	–
17 St. Luke's Church & School	70	55	Less than 65	Less than 55	No	No	–
18 West Hotel	–	55	77-69	67-59	Yes	Yes	West Street
19 Federal Detention Headquarters	–	55	79-70	69-60	Yes	Yes	West Street
20 Hide-a-Way Motel	–	55	83	73	Yes	Yes	West St. & Transitway
Residential							
West Village Housing	–	55	78-63	68-53	380 Units	80 Units	Local Traffic
21 Facing West Street	–	55	78	68			West Street
22 On Morton at Washington St.	–	55	67	67			Local Traffic
23 On Washington Street	–	55	63	53			
Westbeth Housing	–	55	77-63	67-53	325 Units	300 Units	West Street
24 Facing West Street	–	55	77	67			West Street
25 On Bethune at Washington St.	–	55	66	56			Local Traffic
26 On Washington Street	–	55	63	53			
27 Other Existing Residential Units Impacted from Canal Street to West 14th Street, West Street to Hudson Street	–	55	79-66	69-56	276 Units	115 Units	Local Traffic
Community Planning District 4							
Recreational Open Space							
28 Smith Park	70	–	69-65	–	0	0 Acres	–
29 DeWitt Clinton Park	70	–	60/62	–	0	0 Acres	–
Institutional Uses							
30 Bayview Drug Rehabilitation Center	–	55	80-72	70-62	Yes	Yes	Mainline
Rooftop Recreational Area	70	–	72	–	Yes	Yes	Mainline
31 General Theological Seminary	–	55	65-60	55-50	No	No	Mainline
32 Guardian Angel Church & School	–	55	66-65	56-55	Yes	No	Local Traffic
33 Terminal Hotel	–	55	74-70	64-60	Yes	No	Local Traffic
34 Sheraton Motor Inn	–	55	78-67	53-42	No	No	–
Rooftop Swimming Pool	70	–	62	–	No	No	–
Residential							
35 Chelsea Residences Existing Chelsea Residential Units Impacted from West 14th Street to West 30th Street, Twelfth Avenue to Ninth Avenue	–	55	69-66	59-56	34 Units	0	Local Traffic
36 Clinton Residences Existing Clinton Residential Units Impacted from West 34th to West 54th Street	–	55	78-66	68-56	24 Units	24 Units	West Street/12th Ave.

(a) Cannot be Assessed

Secondary Impact Area

Although the Federal Highway Administration does not require an assessment of noise outside of the immediate impact area of a project, an analysis of noise in the adjacent communities has been included in this Project in response to the concern of the Steering Committee.

An extensive study of noise in the secondary impact area was made, including measurements at 49 randomly chosen sites, and at 15 sites chosen for particular sensitivity to noise. The predicted noise in the secondary area is not compared to the FHWA Design Noise Levels, since this traffic noise is not subject to FHWA standards. Instead, the impact is measured by comparison with the existing 1972 noise levels, which allows assessment of changes in secondary area traffic induced by the Project alternatives, and the noise effects of those changes.

As previously noted, trucks and buses dominate noise both in 1972 measurements and in 1995 predictions. Because of the nature of the vast majority of truck trips in the area, very little of this traffic can be diverted to a new highway. Were the individual vehicles to maintain their present high noise emission levels, there would be little change between the noise measured in 1972 and that expected to occur in 1995. However, since truck and bus noise emissions are expected to drop some 10 dB by 1995, there would be a decrease in actual noise levels at most locations.

Predicted secondary area noise levels are expected to decrease under all of the Project alternatives, as detailed in the technical report on noise.

Table 72 Outboard Alternative

Community Planning District 1	National FHWA Noise Standards Urban, Suburban & Rural		Predicted Noise in 1995 (dBA L_{10})		Amount of Space or Number of Residential Units Impacted		Dominant Traffic Noise Source
	Exterior	Interior	Exterior Level	Corresponding Interior	Above FHWA Standard	Above Standard & Local Traffic Noise	1995
1 Battery Park City	70	55	83-78	(a)	(a)	(a)	–
Recreational Open Space							
2 Trinity Place Sitting Areas	70	–	74-70	–	3 Acres (100%)	0 Acres	Brooklyn Battery Tunnel
3 World Trade Center Plaza	70	–	72-64	–	4 Acres (10%)	4 Acres (10%)	Mainline
4 Washington St. Urban Renewal Area Plaza	70	–	75-69	–	3 Acres (80%)	3 Acres (80%)	Mainline
Institutional Uses							
5 Church of St. Joseph	–	55	80	61	Yes	Yes	West Street
6 Washington St. Urban Renewal Area Manhattan Community College	–	55	80-79	55-54	No	No	–
7 Washington St. Urban Renewal Area Public School (Site 5)	–	55	73	63	Yes	Yes	West Street
Residential							
Washington St. Urban Renewal Area							
8 Site 5 (Murray to Duane Sts.)	–	55	74-66	64-56	2000 Units	2000 Units	Mainline/West St.
9 Site 3 (Duane to N. Moore Sts.)	–	55	75-67	65-57	1330 Units	485 Units	Local Traffic
10 Site 1 (N. Moore to Hubert Sts.)	–	55	72-67	62-57	400 Units	145 Units	Local Traffic
11 Other Existing Residential Units Impacted	–	55	80-66	70-56	21 Units	1 Unit	Local Traffic
Community Planning District 2							
Recreational Open Space							
12 Morton Street Pier/ Waterside Park	70	–	76-64	–	2.8 Acres (25%)	2.8 Acres (25%)	West Street
13 Westbeth Plaza	70	–	71-68	–	1 Acre (10%)	1 Acre (10%)	West Street
Institutional Uses							
14 Maritime School Ship, Interior	–	55	–	50-35	No	No	–
Exterior Activities	70	–	76-66	–	Yes	Yes	Mainline
15 Keller Abingdon Hotel & Christopher Hotel	–	55	77-70	67-60	Yes	Yes	West Street
16 St. Veronica's Church & School	–	55	Less than 65	Less than 55	No	No	–
17 St. Luke's Church & School	70	55	Less than 65	Less than 55	No	No	–
18 West Hotel	–	55	76-69	66-59	Yes	Yes	West Street
19 Federal Detention Headquarters	–	55	77-69	67-59	Yes	Yes	West Street
20 Hide-a-Way Motel	–	55	77	67	Yes	Yes	West St./Transitway
Residential							
West Village Housing	–	55	77-62	67-52	355 Units	120 Units	Local Traffic
21 Facing West Street	–	55	77	67			West Street
22 On Morton at Washington St.	–	55	66	56			Local Traffic
23 On Washington Street	–	55	62	52			–
Westbeth Housing	–	55	77-62	67-52	325 Units	276 Units	West Street
24 Facing West Street	–	55	77	67			West Street
25 On Bethune at Washington St.	–	55	66	56			Local Traffic
26 On Washington Street	–	55	62	52			–
27 Other Existing Residential Units Impacted from Canal Street to West 14th Street, West Street to Hudson Street	–	55	78-66	68-56	280 Units	110 Units	Local Traffic
Community Planning District 4							
Recreational Open Space							
28 Smith Park	70	–	85-66	–	6.5 Acres (85%)	6.5 Acres (85%)	Transitway
29 DeWitt Clinton Park	70	–	71-62	–	3 Acres (5%)	3 Acres (5%)	Mainline
Institutional Uses							
30 Bayview Drug Rehabilitation Center	–	55	78-67	68-57	Yes	Yes	West Street
Rooftop Recreational Area	70	–	63	–	No	No	–
31 General Theological Seminary	–	55	Less than 65	Less than 55	No	No	–
32 Guardian Angel Church & School	–	55	Less than 65	Less than 55	No	No	–
33 Terminal Hotel	–	55	Less than 65	Less than 55	No	No	–
34 Sheraton Motor Inn	–	55	78-66	53-41	No	No	–
Rooftop Swimming Pool	70	–	66	–	No	No	–
Residential							
35 Chelsea Residences Existing Chelsea Residential Units Impacted from West 14th Street to West 30th Street, Twelfth Avenue to Ninth Avenue	–	55	Less than 65	Less than 55	0 Units	0 Units	–
36 Clinton Residences Existing Clinton Residential Units Impacted from West 34th to West 54th Street	–	55	77-66	67-56	24 Units	24 Units	West Street/12th Ave.

(a) Cannot be Assessed

Noise Abatement Measures

A three-part approach is needed to achieve the maximum benefit from the control of highway-generated noise—reduction of sound at the motor vehicle source, control of the use of land in the vicinity, and noise abatement measures in highway design. Although control of vehicle noise emissions and land uses is outside the direct influence of this Project, they are suggested in conjunction with noise abatement considerations.

A complete list of the Project noise abatement options is included as Table 77. The table serves as a summary of the noise abatement potential, including the types of locations at which each particular option would reduce noise. The table also indicates the limitations of each option.

Where trucks or buses completely dominate the noise, reducing their volumes can provide modest amounts of noise abatement. Extremely large volume reductions are needed for larger benefits. For example, a reduction in volume from 100 trucks per hour to 10 trucks per hour is needed to achieve a reduction of 10 dB. Such large volume reductions would have to be accompanied, in most instances, by corresponding reductions in automobile volumes to be effective. As indicated by the second entry in Table 77, a reduction of automobile volumes only cannot produce any significant noise reduction at locations where trucks and buses dominate the noise. This is the situation projected to occur throughout the study area for all alternatives. Wherever all three types of vehicles contribute equally to the noise, reductions are needed in all volumes to reduce the traffic noise in the community.

The fourth and fifth table entries concern speed. Where only automobiles are allowed on the mainline highway included in the alternative, a reduction in speed would reduce the noise. Modest speed reductions can produce significant results, since automobile noise falls sharply with decreased speed. Noise from individual trucks, however, is essentially independent of speed. Therefore, a speed reduction produces no benefit where the noise is dominated by trucks. On the contrary, a reduction in speed with no change in vehicle volume results in the trucks moving closer together on the roadway, and thereby increases the noise. This increase is very pronounced in areas of congestion, either on the mainline or on West Street-Twelfth Avenue. At such locations, where the average speed is below 10 miles per hour, relieving traffic congestion would reduce traffic noise. Relatively large speed increases are needed. However, at some of the congested locations, computed speeds would be as low as one mile per hour, and a significant increase in speed is possible at these locations.

Table 73 **Landfill Open Space**

Inboard Alternative	FHWA Standard	Predicted Noise in 1995 dBA L 10	Dominant Traffic Noise Source 1995
37 200 feet from North Edge of Pier 40 (between Morton & Leroy Sts.)	70	65	–
38 200 feet from Northern Entrance to covered section (vicinity 14th St.)	70	67	–
39 50 feet from West St.	70	74	West St.
Outboard Alternative			
40 200 feet from Southern Entrance to covered section (vicinity Houston St.)	70	80	Mainline
41 200 feet from Transitway Entrance at 14th St.	70	80	Transitway
42 200 feet from Northern Entrance to covered section (vicinity W. 27th St.)	70	65	–

A rough pavement surface increases the noise of individual vehicles. This effect was measured on cobblestone streets in the study area during the noise measurement program. For the calculations of 1995 noise, streets were assumed to be free of cobblestones and also rail tracks. For this reason, no further noise reduction can be obtained by a change in surface materials.

Trees and shrubbery can provide very significant noise reduction in rural areas, where space necesssary to support their growth is available. As Table 77 indicates, several hundred feet of dense growth is needed to achieve a 10 dB reduction. The planting of this amount of growth, complete with mature undergrowth or shrubbery, is not feasible on the West Side of Manhattan, and shielding of the upper stories of buildings would not be effected in any case.

Obstruction of the line between the roadway and sensitive sites by earth berms or transparent barriers is quite feasible at specific sites where activities are restricted to ground elevation. For such areas, barriers enveloping the sensitive activity are sometimes feasible. Protection of upper stories in this manner is not possible, because of the unreasonably great height that would be required for the barriers.

Two table entries concern the modification of individual buildings to improve their outdoor-to-indoor noise reduction. Noise is reduced from outdoors to indoors even when windows are open. This reduction is increased greatly by closing the windows. But such an option is not realistic unless the building has some means of forced air ventilation to allow windows to remain closed through the year.

To protect indoor sites where windows do not have to remain open for ventilation, three basic possibilities exist. First, an additional 15 dB reduction can be obtained by closing the windows and providing a good gasket around the window edges. Second, another 10 dB reduction, to a total of 25 dB, can be obtained by substituting nonoperable, double-glazed windows. Such a sealed construction is undesirable for residences, but quite satisfactory for institutional uses. The double-glazing involves two separate panes of glass separated by a minimum of three to four inches of air space. Prefabricated units of this type are manufactured for noise control purposes. An intermediate solution that can provide 10 dB of additional reduction involves specially designed double window construction in which the two panes of glass open at opposite ends. With such construction, the noise enters at one end of the window, travels across the window between the two panes, and then enters the room. During the passage between the panes, part of the noise is absorbed by acoustical material. Such windows can provide the 10 dB reduction even while open. However, forced air ventilation is also needed, since these windows significantly restrict the air flow.

The last options listed in the table relate to control of noise from the portals of covered sections on the Inboard and Outboard alternatives. A 10 dB reduction is a practical limit for noise reduction achievable in this manner. The words "no effect" entered in the table indicate that the noise emanating from the portal of the covered section does not dominate the noise generated by an alternative in that area, and therefore acoustical absorption would not eliminate the impact.

Noise Control Possibilities

Noise control possibilities are discussed for sites where the projected 1995 noise levels are expected to be above the FHWA Design Noise Levels. It must be realized that noise control techniques will change between now and the time of construction. New and improved solutions will be developed, perhaps having fewer detrimental side effects, and these may be feasible for specific sites within the Study Corridor. Therefore, the solutions suggested below may be modified. In all cases, the Project is committed to spend whatever funds are necessary and legally available in order to eliminate noise impacts above standards, where feasible, in implementing a particular alternative.

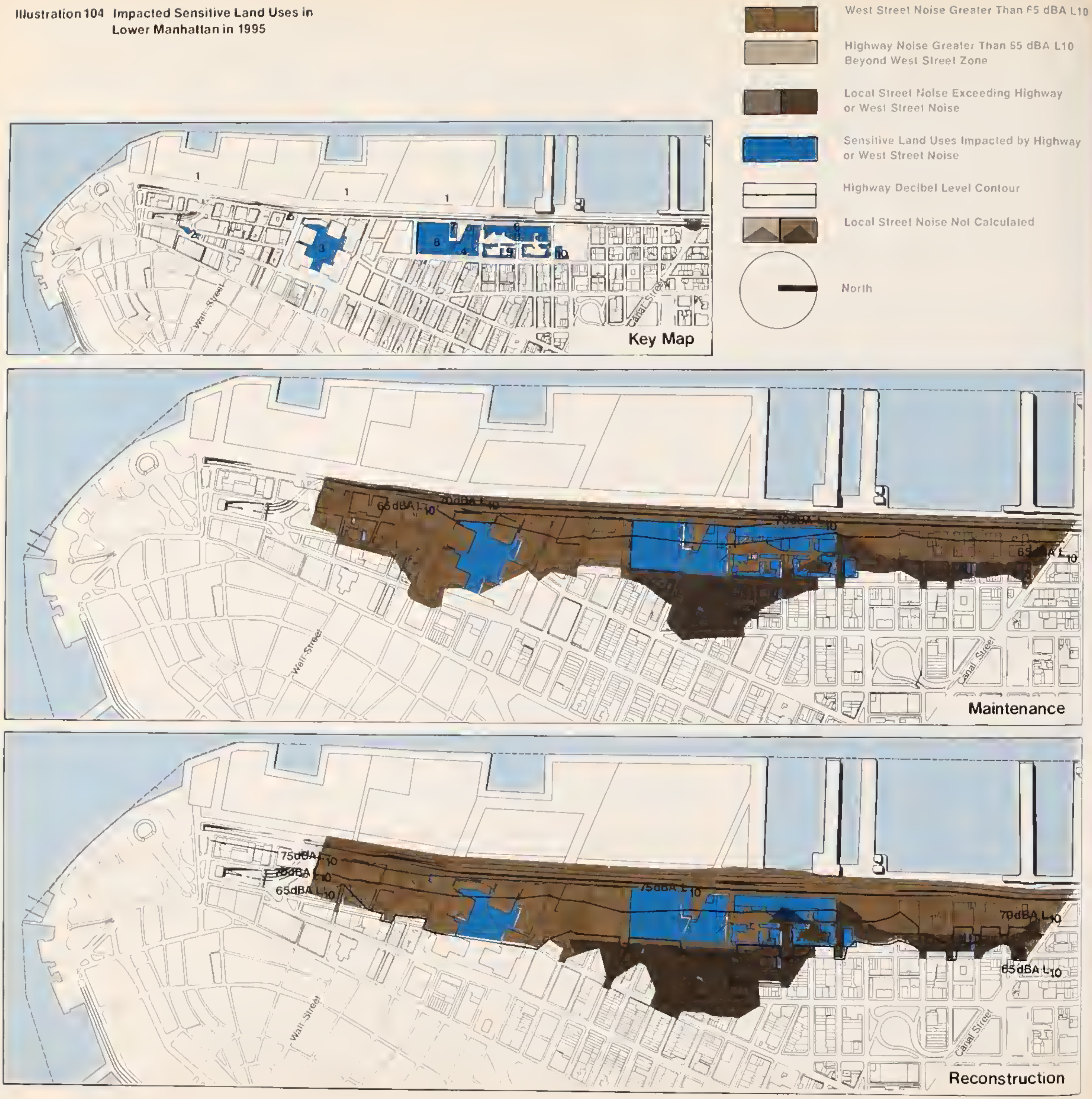
At the sites discussed below, more precise study is needed to refine the noise abatement solution. Such a study will be undertaken during the detailed design after one alternative is selected. The study will tailor the noise control solution to the specific amount of reduction needed for the chosen alternative. Therefore, the discussion which follows is necessarily general, but is based on land-use types and the tables showing comparison of noise impacts among alternatives.

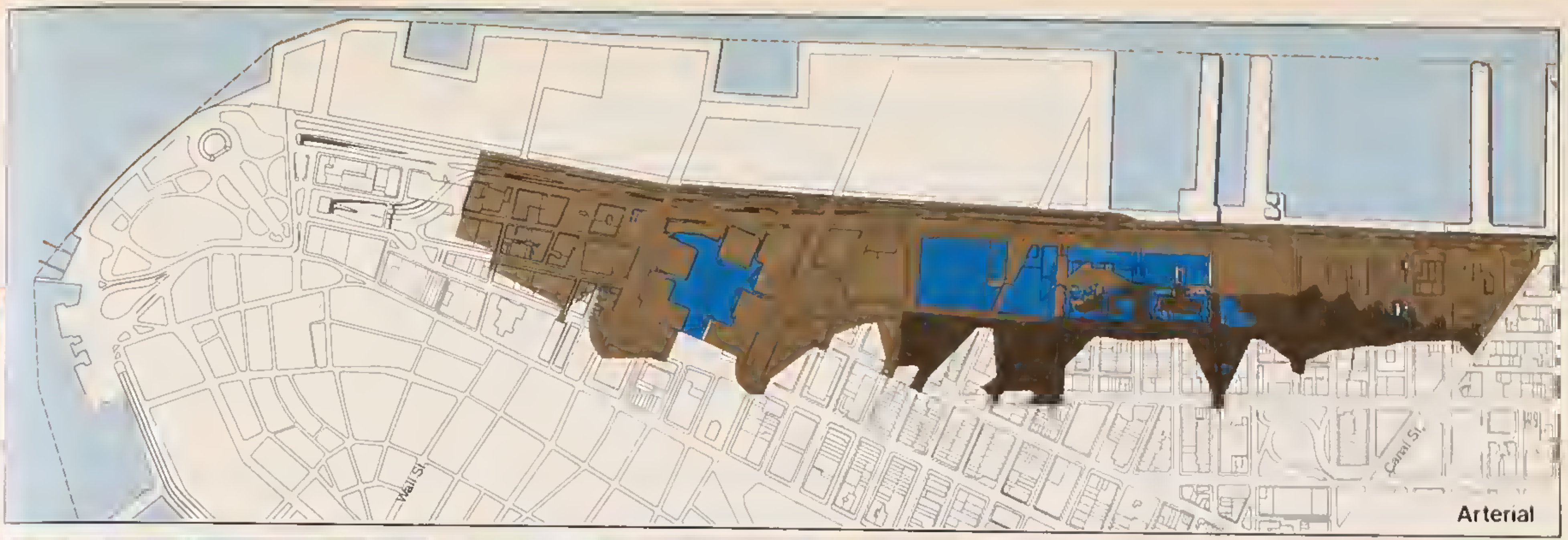
In Lower Manhattan, the triangular sitting areas on Trinity Place would exceed FHWA limits with each alternative. However, noise emanating from the Brooklyn-Battery Tunnel portals and noise from the local streets immediately adjacent to these areas would be dominant. The preceding maps indicate the proximity of these sitting areas to the tunnel portal.

Noise at the World Trade Center Plaza would be over the FHWA limit for the Maintenance, Arterial and Outboard alternatives. During the detailed design of the selected alternative, the noise within this plaza would be more precisely calculated, taking into account the effect of the narrow entranceways and the plaza platform. The edge of this platform would provide some shielding from the roadway which was not taken into account in the calculations. After the plaza is completed, measurements can indicate whether this shielding provides sufficient noise reduction by itself, as is expected.

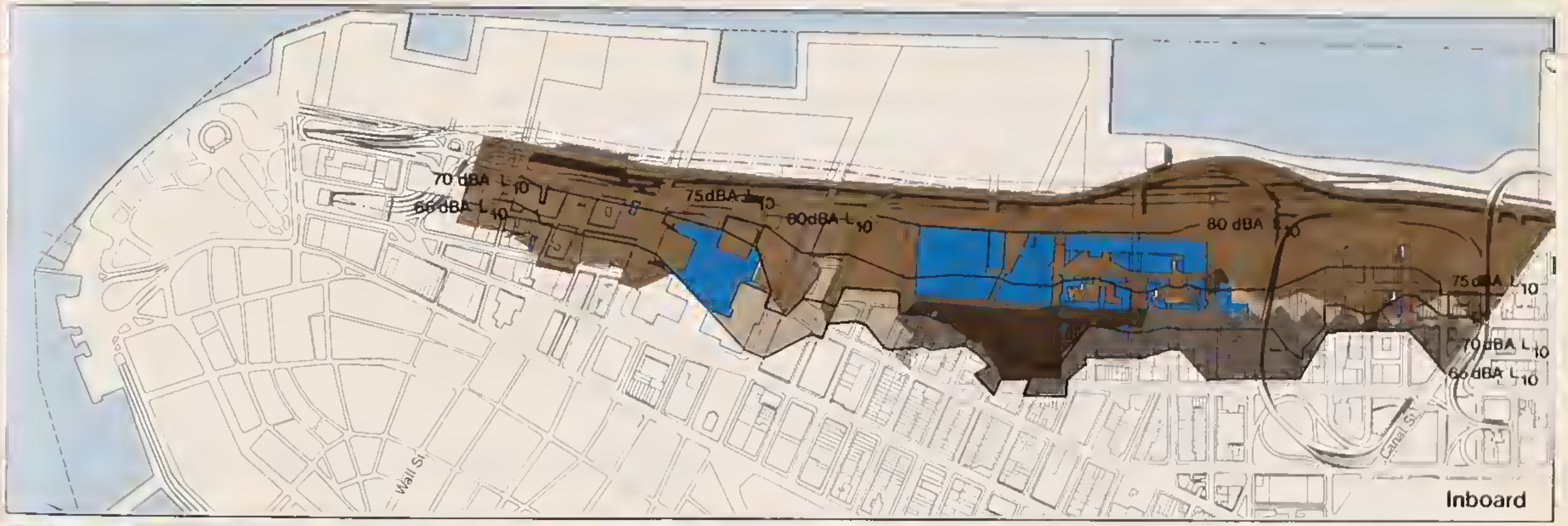
At the Washington Street Urban Renewal Area plaza, noise abatement would be needed for all alternatives. A transparent wall built along the western edge and part of the way along the southern edge of the plaza could provide the necessary shielding, as much as the 17 dB reduction required at the closest position for the Reconstruction alternative. The wall height would vary according to the reduction needed—an approximate height of five feet above the plaza level would bring a 10 dB reduction. Besides being transparent, the wall would be integrated into the park landscaping to minimize any visual bulk. The selection of a satisfactory transparent building material would occur during detailed design of a particular alternative.

Illustration 104 Impacted Sensitive Land Uses in Lower Manhattan in 1995

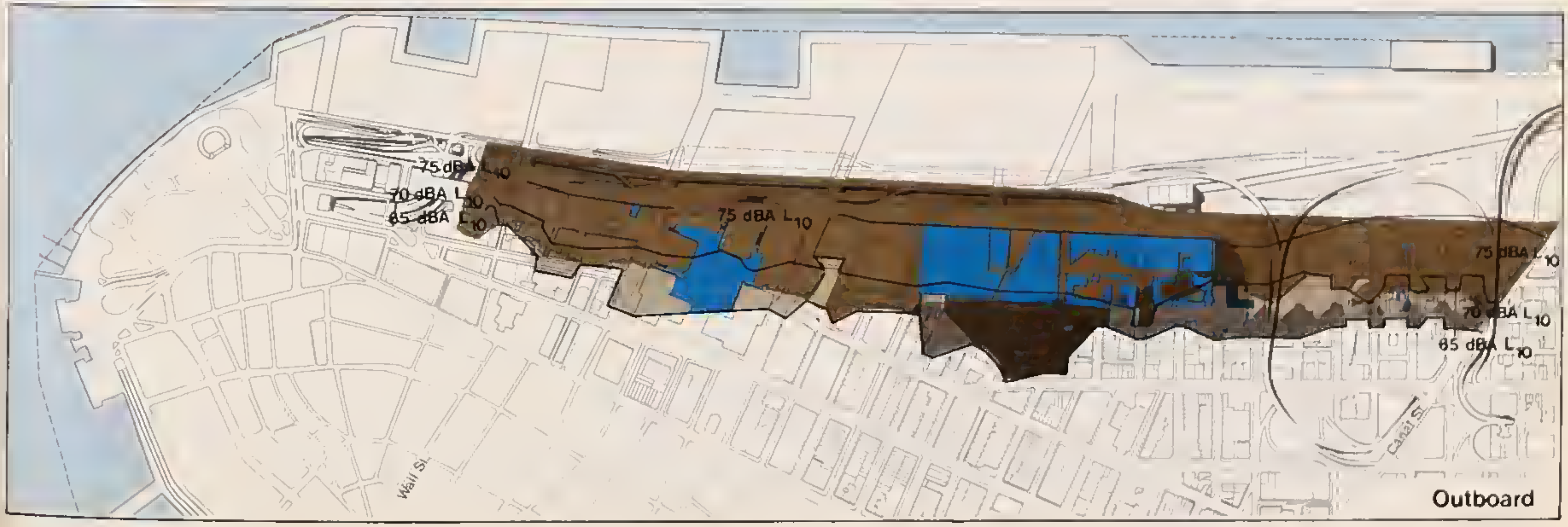

West Street Noise Greater Than 65 dBA L10
Highway Noise Greater Than 65 dBA L10 Beyond West Street Zone
Local Street Noise Exceeding Highway or West Street Noise
Sensitive Land Uses Impacted by Highway or West Street Noise
Highway Decibel Level Contour
Local Street Noise Not Calculated
North
1
1
1
2
3
4
6
7
8
9
10
Wall Street
Canal Street
Key Map
65dBA L10
70dBA L10
70dBA L10
65dBA L10
Wall Street
Canal Street
Maintenance
75dBA L10
70dBA L10
65dBA L10
75dBA L10
70dBA L10
65dBA L10
Wall Street
Canal Street
Reconstruction



Arterial



Inboard



Outboard

In the Greenwich Village area, the Morton Street Pier and Waterside Park would be above the 70 dBA limit for all alternatives. Noise control for the worst of these, the Arterial alternative, would require blocking the direct view between the pier and several blocks along West Street. A wall approximately 10 to 15 feet in height would be required, extending from Pier 40 to Christopher Street and possibly beyond. Access to the pier through the wall would require a labyrinth type entrance. Such a wall would obstruct the view of the water for a significant part of the West Village. Although the noise reduction needed for the Reconstruction alternative would be less, the noise would be generated from trucks on the elevated structure. This source is too high to shield the pier by constructing a wall. For the Reconstruction, Arterial and Inboard alternatives, exceptions would be requested. For the Outboard alternative, the recreational pier would be replaced with park space located in the new landfill.

The small plaza on the Bank Street side of Westbeth Housing would be above the FHWA limits for all alternatives. Protection of this area would be very difficult without eliminating access to the street because of the reverberant nature of the sound in this cross-street corridor, and the lack of room to provide a labyrinth entrance. For the Inboard and Outboard alternatives, the noise excess above the limits would be minimal, and exceptions would be requested for these two alternatives. For the remaining proposals, more study and consultation with the residents of Westbeth would be pursued during the detailed design, to attempt to find a satisfactory solution.

The landfill public park areas created with the Inboard and Outboard alternatives would be partly impacted by noise from the new transportation facilities. Along the West Village waterfront, noise emanating from the southern portal of the Outboard roadway would impact open space to the southwest. This land could be protected either by an earth berm or a continuous wall at the edge of the depressed highway section, south of the portal. The berm or wall would run from the portal for a considerable distance, depending upon design. Its height would vary, generally remaining below ten feet.

The 70 dBA noise from West Street traffic would penetrate the landfill area approximately 100 feet for the Inboard alternative, and double that distance for the Outboard. To protect the area from this noise, a large berm from 10 to 15 feet high would be required along the length of West Street. Such a berm would seriously restrict access to the area, as well as block the view of the water. Access could be provided by well-designed, over-lapped breaks in the berm, or by stairways going up and over the berm. Such a berm network would not be recommended as part of the Project. Design of the park space would take into account noise impact, especially for the Outboard alternative, where more flexibility is possible.

Table 74 Comparison of Noise Impacts Community Planning District 1

Impact of Traffic Noise from Highway, Transitway and West Street. 1995 Noise Levels in Excess of Applicable FHWA Standard dBA L_{10}

Site	FHWA Standard	Maintenance	Reconstruction	Arterial	Inboard	Outboard
1 Battery Park City (Property Line)	70	1 to 11	6 to 16	7 to 14	8 to 16	8 to 13
Recreational Open Space						
2 Trinity Place Sitting Areas	70	0 to 3	0 to 2	0 to 4	0 to 4	0 to 4
3 World Trade Center Plaza	70	0 to 5	0	0 to 10	0	0 to 2
4 Washington Street Urban Renewal Area Plaza	70	3 to 12	7 to 17	1 to 8	3 to 10	0 to 5
Institutional Uses						
5 Church of St. Joseph	55	15	9	14	6	6
6 Washington Street Urban Renewal Area Manhattan Community College	55	0	2 to 3	1 to 2	2	0
7 Washington Street Urban Renewal Area Public School	55	10	15	9	11	8
Residential						
Washington Street Urban Renewal Area						
8 Site 5	55	4 to 17	9 to 24	2 to 15	7 to 15	1 to 9
9 Site 3	55	0 to 9	0 to 15	2 to 11	6 to 11	2 to 10
10 Site 1	55	0 to 10	0 to 8	4 to 11	7 to 13	2 to 7
11 Other Existing Residential Units Impacted	55	3 to 24	2 to 18	3 to 23	1 to 15	1 to 15

Where impact on park space cannot be avoided along West Street, an exception would be requested.

For the Outboard alternative, the noise emanating from the covered transitway at 14th Street and at 23rd Street would seriously affect the use of the nearby new park areas. The 23rd Street portal noise would impact nearly all of the area tentatively planned as space for the relocated Smith Park. As the general table on noise abatement indicates, acoustical absorption on the ceilings of the covered section could reduce the portal noise by approximately 10 dB. This would reduce the impacted land area by a factor of ten, but some of the area would still be above the FHWA standard for parks. Consideration should be given to relocating Smith Park to a quieter spot if this alternative is selected.

In Community Planning District Four, Smith Park has been discussed with the landfill area for the Outboard alternative. It would be impacted above FHWA limits for the Maintenance alternative as well. The park would be relocated under the Inboard, Reconstruction and Arterial alternatives if Federal funds were used for implementation. At the relocated position, on Tenth Avenue between 18th and 21st Streets, the park would be above 70 dBA for the Reconstruction and Arterial alternatives. An exception would be requested, since local traffic noise would predominate. The Inboard alternative, like the Outboard, would employ Federal funds, requiring replacement of affected park lands like Smith Park.

DeWitt Clinton Park would be above the FHWA standard for the Reconstruction and Arterial alternatives. Here, a transparent wall along the western side of the park, extending slightly down 52nd and 54th Streets, would reduce the noise by the amount required. The wall would have to be eight feet high to obtain a 10 dB noise reduction along the western edge of the park. The Inboard and Outboard alternatives would barely impact the park. The shielding provided by the edge of the park itself would probably reduce the impact the required amount. This shielding was not included in the calculations.

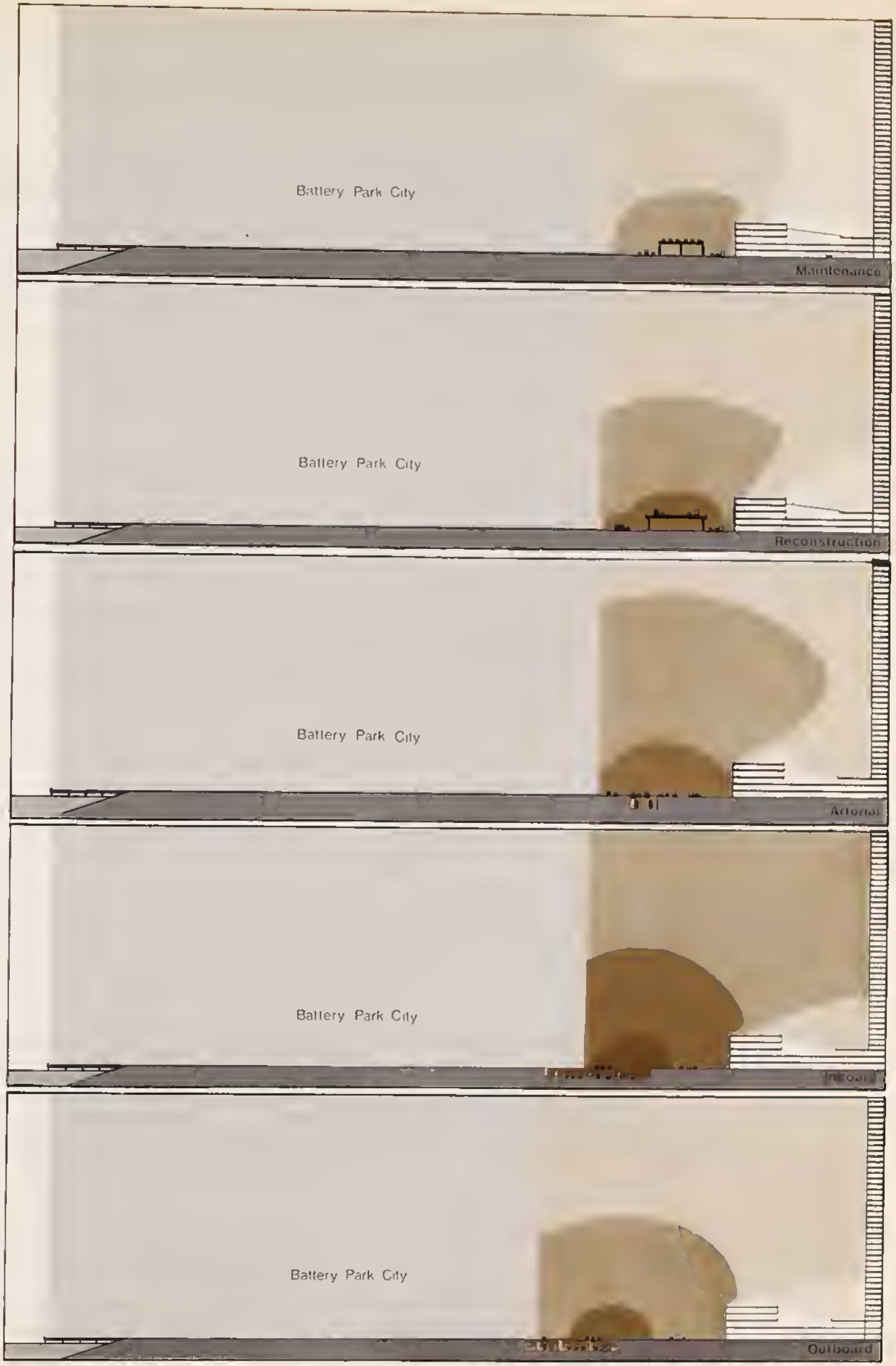


Illustration 105 Noise Profile at Washington Street Urban Renewal Area in 1995

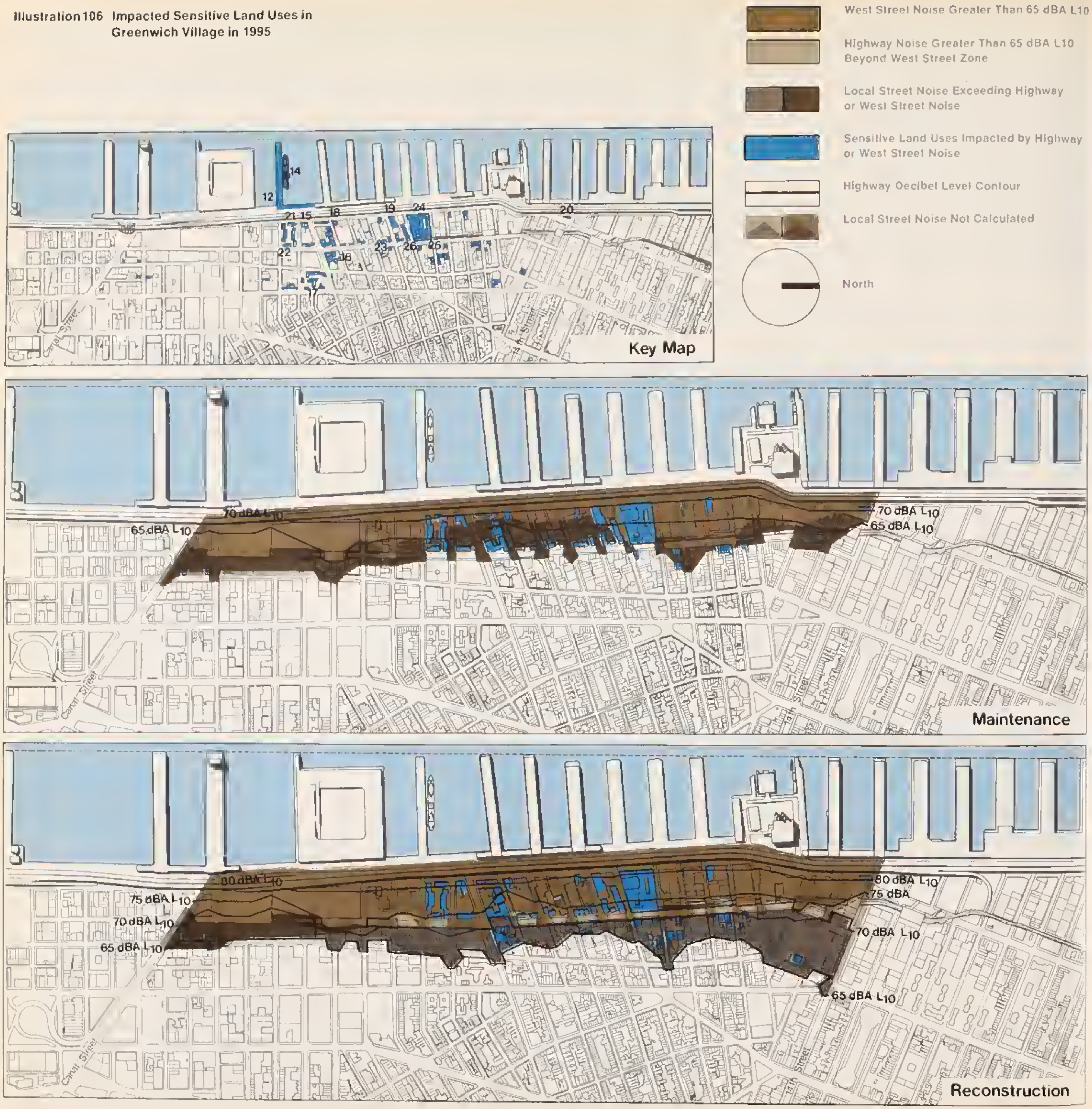
- ☐ Less than 65 dBA L10
- ☐ 65-70 dBA L10
- ▨ 70-75 dBA L10
- ▨ 75-80 dBA L10
- ▨ 80-85 dBA L10
- ■ 85-90 dBA L10

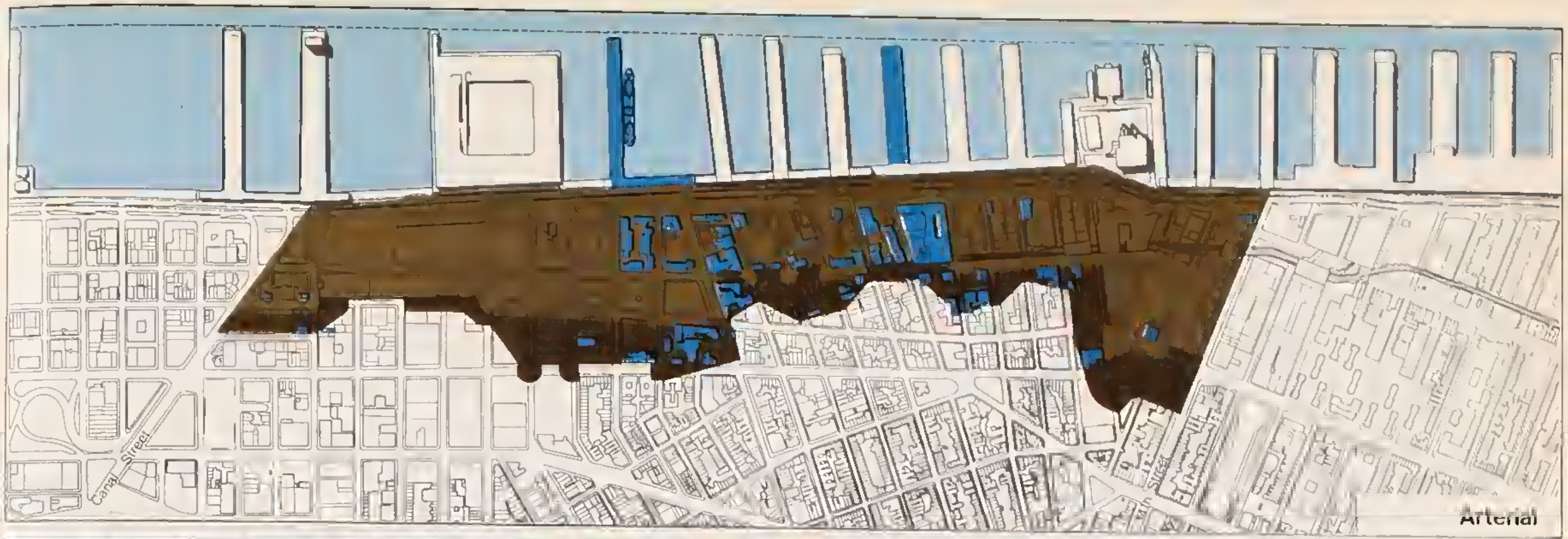
Institutional Uses In Lower Manhattan, the Church of Saint Joseph would be impacted by all the alternatives when its windows are open. With the windows closed, the outdoor-to-indoor noise reduction was measured at 31 dB. Under these conditions, the interior noise would range from 49 to 57 dBA for the Reconstruction, Arterial, Inboard and Outboard alternatives. The Arterial alternative would remain 2 dB above the 55 dBA standard. To achieve that additional 2 dB, the windows could be gasketed, and the air-conditioning improved to provide year-round ventilation as well as cooling, both to the sanctuary and to the living quarters on the second floor. In addition, the living quarters would require non-operable double-glazed windows. These improvements would reduce the noise levels below the FHWA standard.

The proposed Manhattan Community College would be exposed to noise slightly above FHWA limits by the Reconstruction, Arterial and Inboard alternatives. Improving the outdoor-to-indoor noise reduction of the windows facing West Street would be a feasible solution. Since the college is to be equipped with central air-conditioning and good window construction, recourse would have to be to double-glazing. Before this were decided, the actual outdoor-to-indoor noise reduction afforded by the structure would be measured to determine if the structure itself would provide the additional 2 to 3 dB reduction needed.

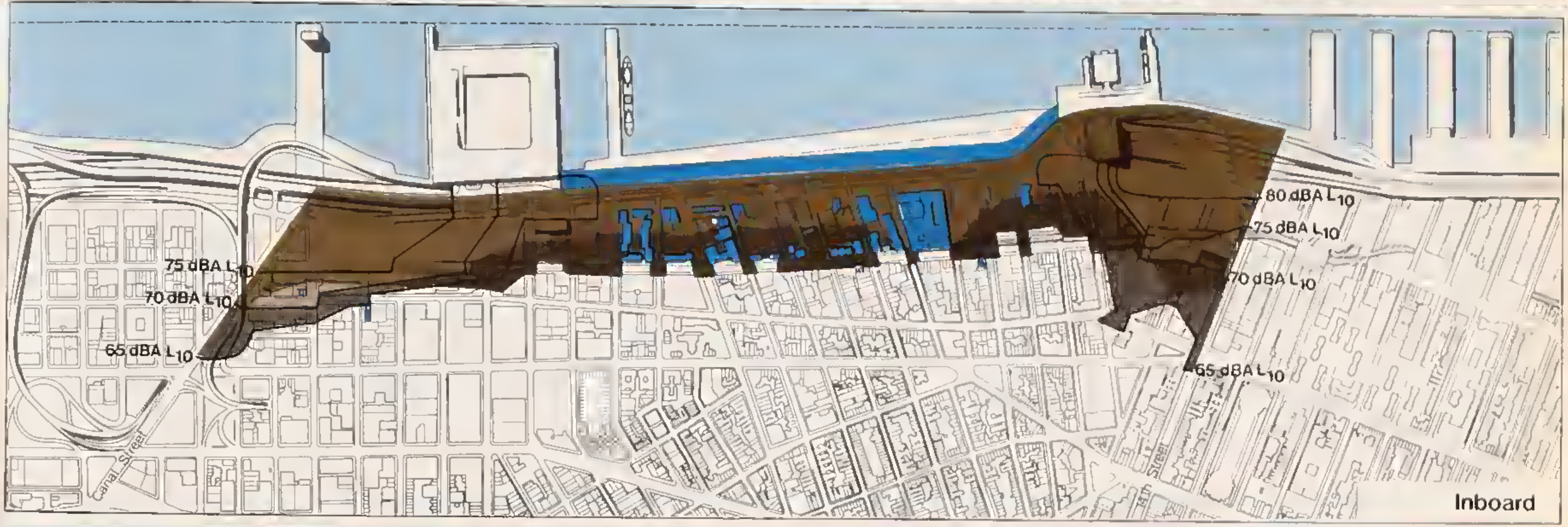
The public school planned within Site 5 of the Washington Street Urban Renewal Area would be exposed to excess noise by each alternative. The most severe impact would result from the Reconstruction alternative, for which an additional 15 dB reduction is needed. If the school were air-conditioned and the windows well gasketed, the noise would be reduced below the standards.

Illustration 106 Impacted Sensitive Land Uses in Greenwich Village in 1995

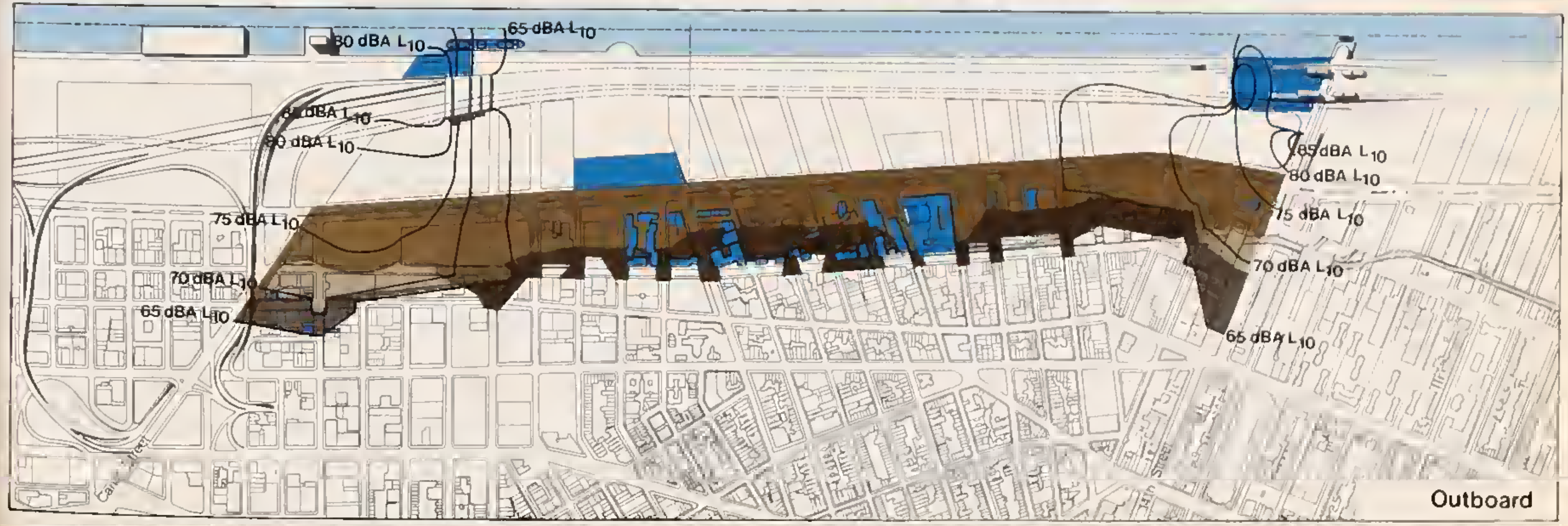

West Street Noise Greater Than 65 dBA L10
Highway Noise Greater Than 65 dBA L10 Beyond West Street Zone
Local Street Noise Exceeding Highway or West Street Noise
Sensitive Land Uses Impacted by Highway or West Street Noise
Highway Decibel Level Contour
Local Street Noise Not Calculated
North
Key Map
12
14
21
15
18
19
24
20
22
16
23
26
25
17
Canal Street
14th Street
Maintenance
70 dBA L10
65 dBA L10
70 dBA L10
65 dBA L10
Reconstruction
80 dBA L10
75 dBA L10
70 dBA L10
65 dBA L10
80 dBA L10
75 dBA
70 dBA L10
65 dBA L10



Arterial



Inboard



Outboard

Table 75 Comparison of Noise Impacts Community Planning District 2

Impact of Traffic Noise from Highway, Transitway and West Street. 1995 Noise Levels in Excess of Applicable FHWA Standard dBA L_{10}

Site	FHWA Standard	Maintenance	Reconstruction	Arterial	Inboard	Outboard
Recreational Open Space						
12 Morton St. Pier/Waterside Park & Replacements	70	0 to 8	1 to 14	6 to 20	0 to 4	0 to 5
13 Westbeth Plaza	70	3 to 5	7 to 10	3 to 7	0 to 2	0 to 1
Institutional Uses						
14 Maritime School Ship	55	0	0	0 to 3	0	0
15 Keller Abingdon Hotel & Christopher Hotel	55	10 to 16	13 to 19	20	7 to 14	5 to 12
16 St. Veronica's Church & School	55	0	1 to 3	0 to 9	0	0
17 St. Luke's Church & School	55	0	0	1 to 9	0	0
18 West Hotel	55	12 to 18	13 to 18	12 to 16	4 to 12	4 to 11
19 Federal Detention Headquarters	55	4 to 15	12 to 18	10 to 17	5 to 14	4 to 12
20 Hide-a-Way Motel	55	15	18	21	18	12
Residential						
West Village Housing						
21 Facing West Street	55	16	19	23	13	12
22 On Morton at Washington Street	55	5	10	15	2	1
23 On Washington Street	55	0	7	9	0	0
Westbeth Housing						
24 Facing West Street	55	18	18	16	12	12
25 On Bethune at Washington Street	55	7	9	8	1	1
26 On Washington Street	55	0	6	3	0	0
27 Other Existing Residential Units Impacted	55	1 to 16	1 to 18	1 to 16	1 to 14	1 to 13

Table 76 Comparison of Noise Impacts Community Planning District 4

Impact of Traffic Noise from Highway, Transitway and West Street. 1995 Noise Levels in Excess of Applicable FHWA Standard dBA L_{10}

Site	FHWA Standard	Maintenance	Reconstruction	Arterial	Inboard	Outboard
Recreational Open Space						
28 Smith Park & Replacements	70	0	0 to 2	0 to 6	0	0 to 15
29 DeWitt Clinton Park	70	0	0 to 7	0 to 10	0	0 to 1
Institutional Uses						
30 Bayview Drug Rehabilitation Center	55	5 to 14	12 to 18	13 to 22	7 to 15	2 to 13
31 General Theological Seminary	55	0	0 to 5	0 to 5	0	0
32 Guardian Angel Church & School	55	0	3 to 6	3 to 6	0 to 1	0
33 Terminal Hotel	55	0	11 to 12	8	5 to 9	0
34 Sheraton Motor Inn	55	0	0	0 to 5	0	0
Residential						
35 Chelsea Residences						
Existing Chelsea Residences Impacted	55	1 to 2	1 to 8	1 to 9	1 to 4	0
36 Clinton Residences						
Existing Clinton Residences Impacted	55	1 to 9	1 to 18	3 to 16	1 to 13	1 to 12

In the Village area, the noise at the school ship *S.S. John Brown II* would vary widely among alternatives. No impact is expected for the Inboard. For the Outboard, the ship could be rebirthed several hundred feet to the north of the tunnel portal, where the noise would be below the standards. For the Reconstruction and Arterial alternatives, nothing could be done to protect the exterior instruction spaces from excess noise impact, other than berthing the ship somewhere else. The Arterial alternative noise would be particularly severe, and would badly interfere with instruction over large distances, as with lifeboat lessons. Exceptions to the FHWA Design Noise Levels would be requested for the Arterial and Reconstruction alternatives.

Four small hotels in Community Planning District Two would be impacted above the FHWA standards by each alternative. The required noise reduction ranges from 11 dB to 21 dB. Although the necessary noise reductions could be obtained by providing forced-air ventilation and renovating the window structure, it is probable that the hotels would instead be purchased and demolished. The hotels involved are the Hide-a-Way Motel on 14th Street, the West Hotel on Jane Street, the Christopher Hotel on Christopher Street and the Keller Abingdon Hotel on Barrow Street.

The Federal Detention Headquarters in the West Village also would be impacted above the FHWA standards by each alternative. Forced-air ventilation of this public institution and a permanent sealing of the windows facing both West and 11th Streets would reduce the interior noise below FHWA standards.

The Saint Veronica Church and School and Saint Luke Church and School would be subject to noise in excess of the FHWA standards. The Saint Veronica facilities would be impacted by the Reconstruction and Arterial alternatives. Saint Luke's would be impacted only by the Arterial. At Saint Veronica's, the necessary 3 to 9 dB noise reduction could be obtained by gasketing windows and centrally air-conditioning the buildings. The same would apply to the church and school at Saint Luke's for the Arterial. It is likely that the actual outdoor-to-indoor noise reduction at Saint Veronica's would exceed the estimated 10 dB and would reduce the noise below the interior standard for the Reconstruction alternative. The reduction provided by the structure should be measured during the detailed design study.

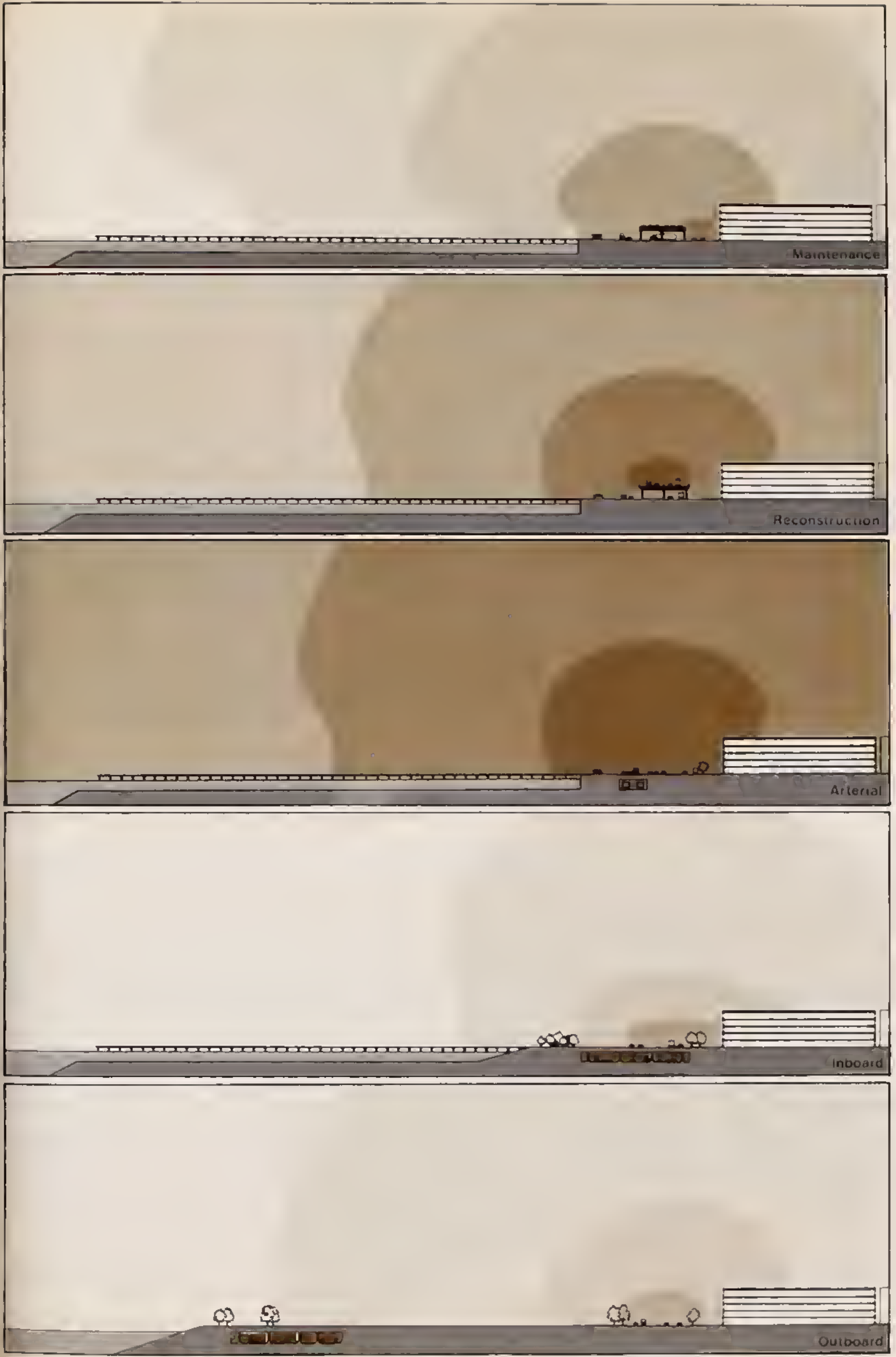


Illustration 107 Noise Profile at West Village Housing and Morton Street Pier in 1995

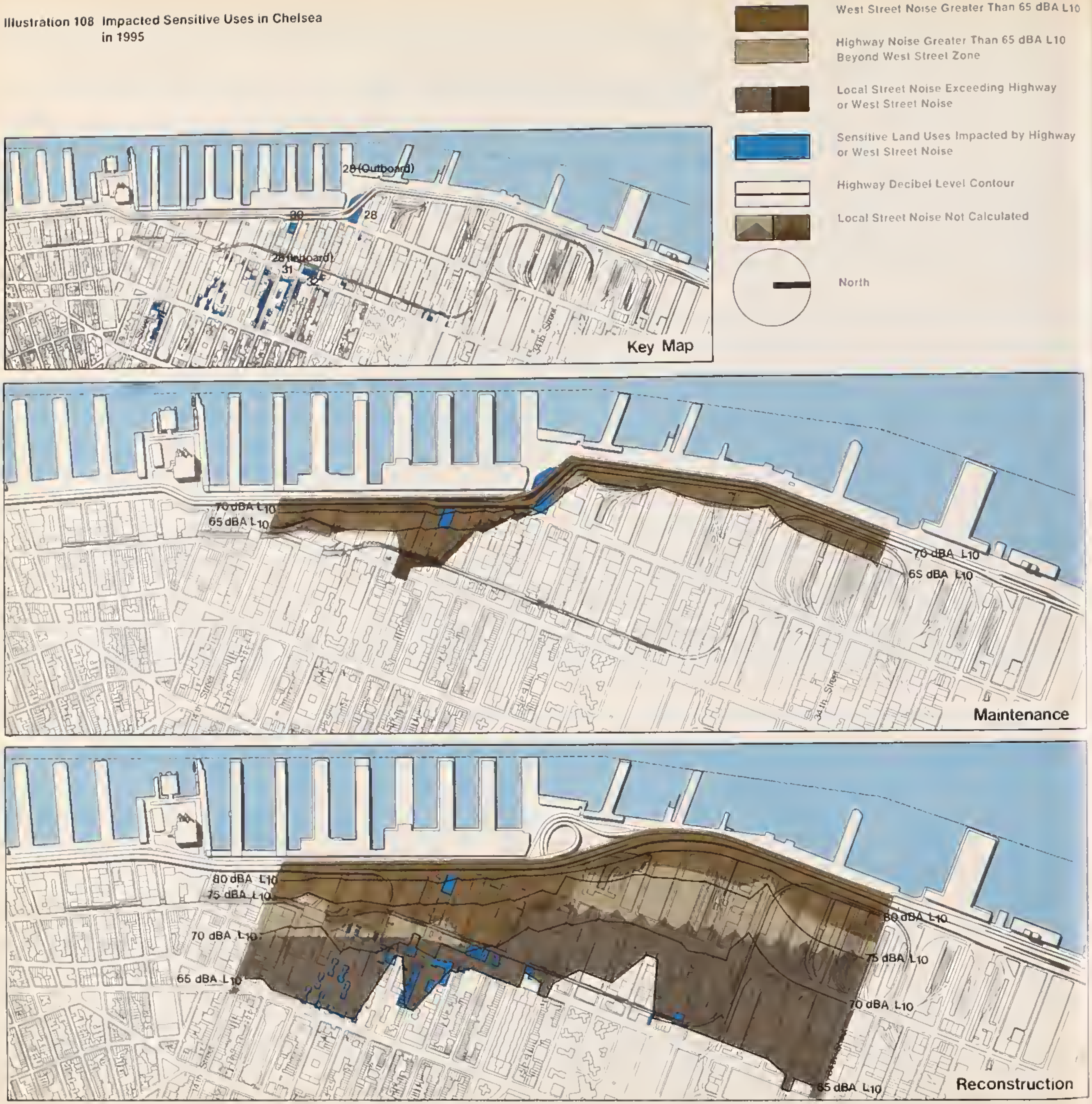
☐ Less than 65 dBA L10
☐ 65-70 dBA L10
☐ 70-75 dBA L10
▨ 75-80 dBA L10
■ 80-85 dBA L10
■ 85-90 dBA L10

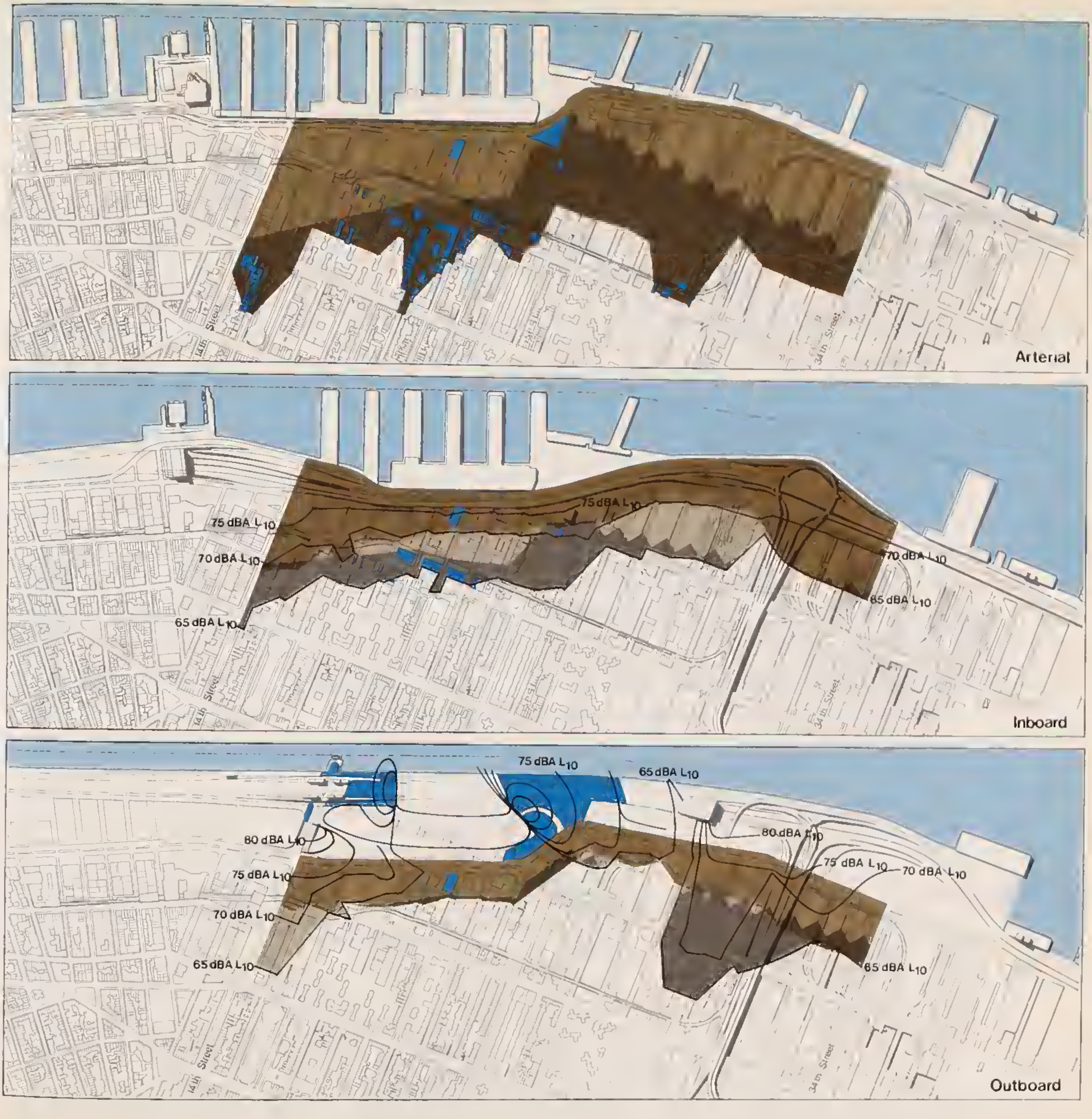
In Community Planning District Four, the Bayview Rehabilitation Center would be severely impacted by each alternative. The windows of the Center could be well gasketed and central air ventilation equipment installed. These two steps would suffice for the Inboard and Outboard alternatives. For the Reconstruction and Arterial alternatives, the windows would have to be replaced with double-glazing, in addition to the steps recommended for the Outboard. The rooftop sports activities are impacted for the Reconstruction, the Arterial and especially for the Inboard. Transparent sheeting outside the metal screening would obstruct the line from the roadway to the sports area. The necessary height of this sheeting would depend upon the alternative chosen, and a more detailed calculation should be made for these roof areas during detailed design.

Exceptions would be requested for the Guardian Angel Church and for the General Theological Seminary, since the local traffic noise would exceed the noise attributable to the Project proposals at these locations.

The Terminal Hotel at the corner of 23rd Street and Eleventh Avenue would be impacted above FHWA standards for all of the alternatives except Maintenance and Outboard. For the Outboard, the covered section of the mainline would extend into the Chelsea area and protect this hotel, as well as large areas of the Chelsea Historic District. For the Reconstruction, Arterial and Inboard alternatives, the hotel could be purchased, a similar solution to that for the small hotels in Greenwich Village.

Illustration 108 Impacted Sensitive Uses in Chelsea in 1995


West Street Noise Greater Than 65 dBA L10
Highway Noise Greater Than 65 dBA L10 Beyond West Street Zone
Local Street Noise Exceeding Highway or West Street Noise
Sensitive Land Uses Impacted by Highway or West Street Noise
Highway Decibel Level Contour
Local Street Noise Not Calculated
North
28 (Outboard)
30
28
28 (Inboard)
31
32
34th Street
14th Street
Key Map
70 dBA L10
65 dBA L10
70 dBA L10
65 dBA L10
34th Street
Maintenance
80 dBA L10
75 dBA L10
70 dBA L10
65 dBA L10
80 dBA L10
75 dBA L10
70 dBA L10
65 dBA L10
Reconstruction


14th Street
34th Street
Arterial
75 dBA L_{10}
75 dBA L_{10}
70 dBA L_{10}
70 dBA L_{10}
65 dBA L_{10}
65 dBA L_{10}
14th Street
34th Street
Inboard
75 dBA L_{10}
65 dBA L_{10}
80 dBA L_{10}
80 dBA L_{10}
75 dBA L_{10}
75 dBA L_{10}
70 dBA L_{10}
70 dBA L_{10}
65 dBA L_{10}
65 dBA L_{10}
14th Street
34th Street
Outboard

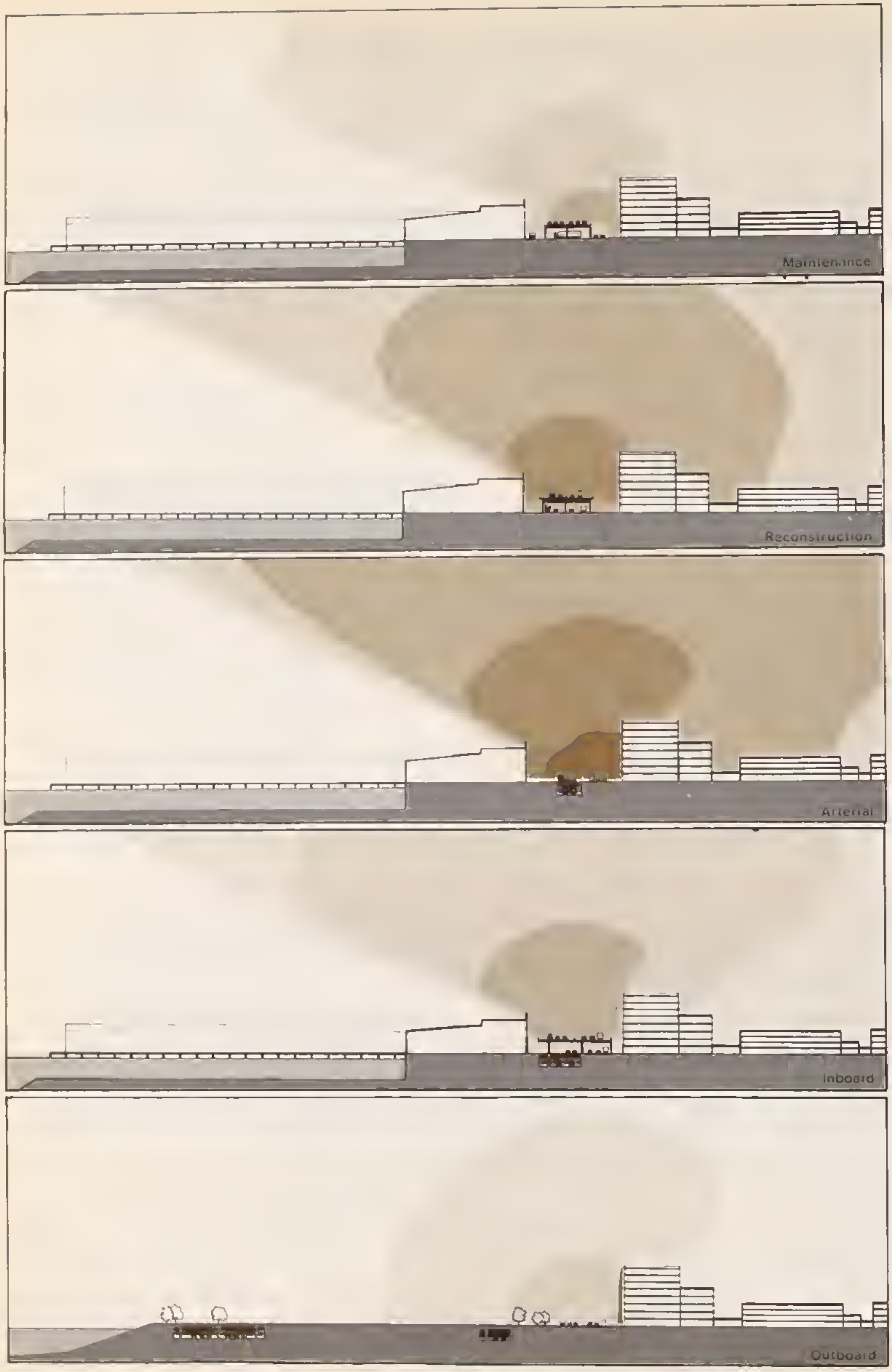


Illustration 109 Noise Profile at Bayview Rehabilitation Center in 1995

□	Less than 65 dBA L10
□	65-70 dBA L10
▨	70-75 dBA L10
▨	75-80 dBA L10
▨	80-85 dBA L10
■	85-90 dBA L10

The Sheraton Motor Inn would be exposed to noise in excess of the FHWA standards only for the Arterial alternative. Since the windows facing Twelfth Avenue are already well gasketed, the outdoor-to-indoor noise reduction should be measured during the detailed design phase. It is expected that the building already provides the necessary 5 dB additional noise reduction needed to satisfy the standards. The swimming pool area on the roof would also be exposed to noise above the standards by the Arterial alternative. Since the users of the pool could gaze down directly onto the Arterial street, nothing could be done in the design of the alternative to reduce noise impact on these persons. A noise barrier at roof level should be investigated during a detailed design study. Such a barrier, perhaps extending horizontally outward from the pool deck some ten feet, would obstruct the direct line from the alternative to the pool users, and thereby produce the required 5 dB noise reduction.

Residential Uses In Lower Manhattan, residents of the Washington Street Urban Renewal Area would be exposed to noise levels above FHWA standards for each alternative. The height of these residential buildings would preclude obstructing the sound path. Such large amounts of noise reduction would be needed that benefits from the possible relief of traffic congestion on any alternative would not suffice. The only feasible method of reducing the noise below FHWA standards would be the improvement of outdoor-to-indoor noise reduction for the buildings themselves. All residences are planned without central air-conditioning. Places in exterior walls for room air-conditioners will be provided, although the individual residents will have to purchase the units themselves, at their option. Even with such units, effective year-round fresh air ventilation is missing. Also, the units themselves transmit exterior noises without much hindrance into the interior spaces. For these reasons, an open-window condition was assumed for the entire urban renewal area in assessing the noise impact. To reduce the impact, forced air

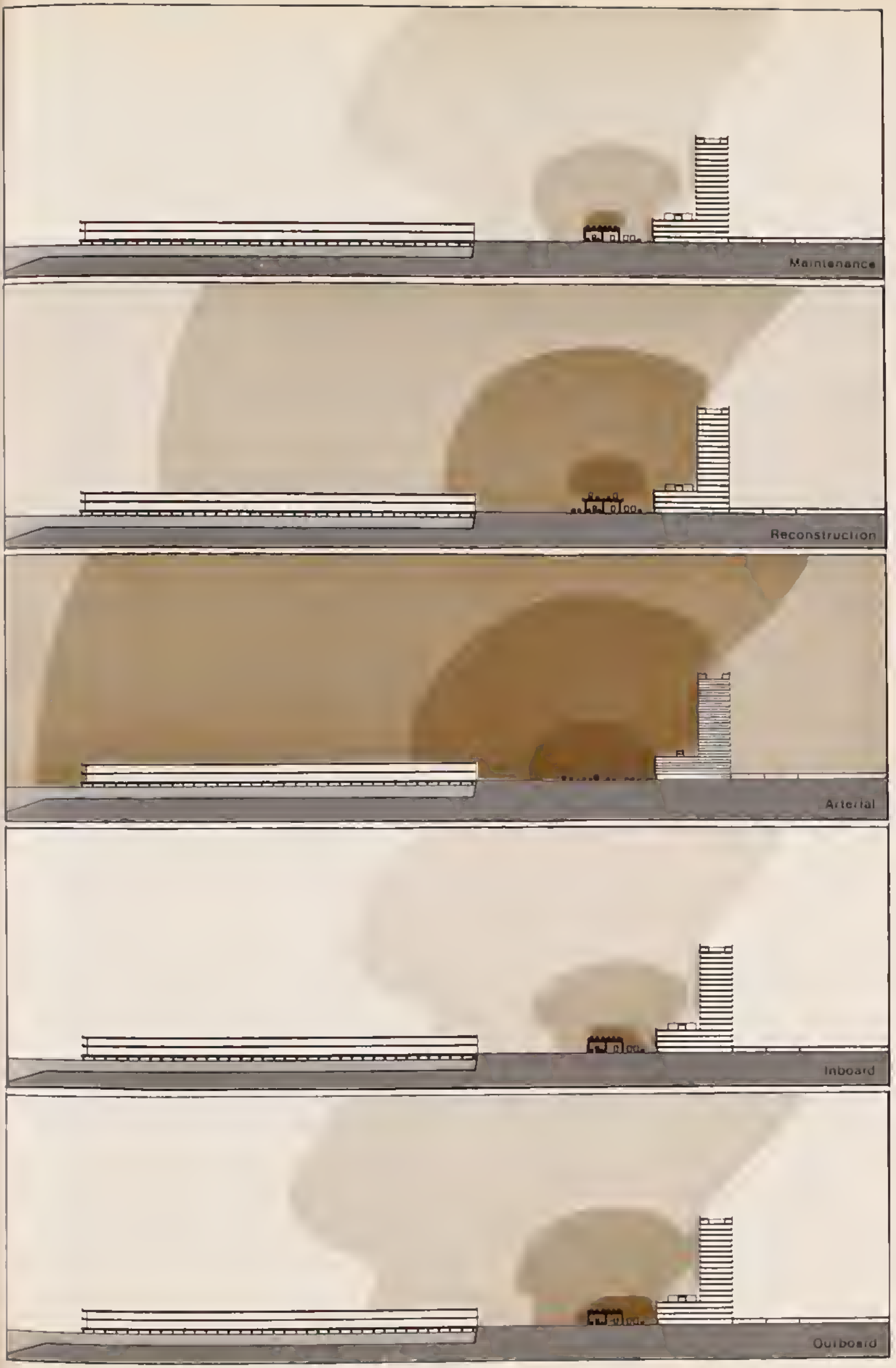


Illustration 110 Noise Profile at the Sheraton Motor Inn in 1995

☐	Less than 65 dBA L10
☐	65-70 dBA L10
▨	70-75 dBA L10
▨	75-80 dBA L10
■	80-85 dBA L10
■	85-90 dBA L10

ventilation would have to be provided. Central air-conditioning is ideal, with provisions for year-round fresh air. Such a system, combined with good window gaskets, would eliminate all interior impact except for the residents facing West Street in Site 5. There, double-glazing would be necessary to provide the additional 9 dB reduction needed.

The buildings on Site 3 have already been constructed, and they provide no facilities for central air distribution. For these buildings, operable double-glazed windows would suffice. The actual outdoor-to-indoor noise reduction of such windows should be computed during the detailed design study, and the windows improved to provide at least a total of 25 dB reduction. This is a 5 dB improvement over the values given in Table 75. With such a design, all impact for these residences could be eliminated, while year-round ventilation would be supplied each apartment individually. Such operable double-glazing could be used on other sites, instead of central ventilation.

In the West Village area, residential impact would also be extensive. Either central air-conditioning, or the operable double-glazed windows could be provided all residences for which the noise from the alternatives would be above both FHWA standards and the local street noise. The affected residences are shown on previous maps. The impact would generally be restricted to those residences facing West Street directly, and some residences back approximately one block from West Street. The number of residences would vary among alternatives, as preceding maps and tables illustrate.

The same noise reduction option is feasible for the residences in Chelsea and Clinton, which would be impacted above both the FHWA standards and local street noise. Where noise from the alternatives would be over the standards, but local street noise dominant, exceptions would be requested.

Table 77 Approximate Effects of Noise Abatement Options

Noise Abatement Option	Type of Location	For 5 db Reduction	For 10 dB Reduction	For 15 dB Reduction	For 25 dB Reduction
Reduce Truck and Bus Volumes	Where trucks and/or buses completely dominate noise	Reduce by factor of 3	Reduce by factor of 10	Reduce by factor of 30	Reduce by factor of 300
Reduce Automobile Volumes	Where trucks and buses dominate noise	No Effect	No Effect	No Effect	No Effect
Reduce Truck, Bus and Automobile Volumes	Where all three contribute equally to the noise	Reduce by factor of 3	Reduce by factor of 10	Reduce by factor of 30	Reduce by factor of 300
Reduce Speed on Mainline Highway	Where autos only allowed on mainline	Reduce by factor of 1½	Reduce by factor of 2	Reduce by factor of 3½	Reduce by factor of 8
Relieve Truck Congestion	Where average speed below 5-10 mph, causing heavy trucks to dominate	Increase speed by factor of 3	Increase speed by factor of 10	Increase speed by factor of 30	Cannot Achieve 25 dB Reduction
Reduce Pavement Roughness (Assumes Cobblestones Removed by 1995)	All locations	No Effect	No Effect	No Effect	No Effect
Plant Trees & Shrubbery	All locations	100-foot band of dense trees and shrubs bordering roadway	200-foot band of dense trees and shrubs bordering roadway	Cannot Achieve 15 dB Reduction	Cannot Achieve 25 dB Reduction
Obstruct Line between Roadway and Site	All locations	Block direct line to major portion of roadway	Shield site from roadway with substantial barrier system	Only for localized sites, most favorable conditions	Cannot Achieve 25 dB Reduction
Improve Outdoor to Indoor Noise Reduction	Indoor sites, windows must now remain open for ventilation	(a)	Provide forced ventilation and special double windows, open	Provide forced ventilation and gasketed single windows, closed	Provide forced ventilation and double windows, non-operable
Improve Outdoor to-Indoor Noise Reduction	Indoor sites with forced ventilation, normal single window construction	Provide good gasketing	Provide double windows, non-operable	Cannot Achieve 15 dB Reduction	Cannot Achieve 25 dB Reduction
Acoustical Ceiling in Covered Sections of Mainline Highway	Within 100 feet of northern mainline portal	Approximately 1000 feet of absorptive ceiling	Cannot Achieve 10 dB Reduction	Cannot Achieve 15 dB Reduction	Cannot Achieve 25 dB Reduction
Acoustical Ceiling	Southern portals	No Effect	No Effect	No Effect	No Effect
Acoustical Ceiling	Within 600-feet of Outboard 14th St. Interchange	Approximately 1000 feet of absorptive ceiling	Cannot Achieve 10 dB Reduction	Cannot Achieve 15 dB Reduction	Cannot Achieve 25 dB Reduction
Acoustical Ceiling in Covered Sections of Busway	14th Street & 23rd Street bus ramps, Outboard Alternative	Approximately 1000-feet of minimal absorption	Approximately 1000-feet of good absorptive ceiling	Cannot Achieve 15 dB Reduction	Cannot Achieve 25 dB Reduction
Acoustical Ceiling in Covered Sections of Busway	Within 1000-feet of 16th Street portal, Inboard Alternative	Approximately 1000-feet of absorptive ceiling	Cannot Achieve 10 dB Reduction	Cannot Achieve 15 dB Reduction	Cannot Achieve 25 dB Reduction

(a) This 5 db improvement over the calculated noise is expected automatically for the average residence, since the calculated impact assumes a 10 dB outdoor to-indoor noise reduction which is overly conservative. This is discussed further in the text.

Note: The effects of some of these noise-abatement options are not cumulative, and therefore, the noise reductions cannot be added together for total reduction in some cases.

Water Quality Impacts

Public interest and perception regarding the Hudson River waterfront and its many potential uses vary significantly with individual and group priorities. The waterfront roles as an economic resource, as a place for recreation, and as a valuable visual asset are all discussed in other parts of this section on probable impacts. The public, however, has exhibited strong support for efforts to clean up and maintain the quality of River water as one of the principle elements of the physical environment.

The Steering Committee recognized the importance of the relationship of the Project to both the waterfront and the River in several dimensions. It also recognized the potential of the Project and its results either to assist or detract from the efforts to improve this important environmental element. One of the five goals established by the Steering Committee is:

- **Improve the quality of the physical environment by reducing pollution attributable to transportation sources in the West Side Corridor.**

Additionally, the Steering Committee adopted five policies, all of which directly or indirectly indicate its concern over improving the quality of water:

- **Incorporate appropriate air, noise and water pollution control devices and design features in the physical plant of the highway.**

- **Provide maximum practicable pollution controls during the construction phase of the project.**

- **Assure that the project design reflects compliance with appropriate federal, state and local air, noise, and water environmental standards and additionally that such standards are adhered to during construction.**

- **Investigate and evaluate the extent to which alternatives reduce the pollution from transportation sources on the West Side Highway and in the adjacent communities.**

- **Assure that reconstruction of the highway avoids diminishing the benefits of pollution control projects being undertaken in the corridor, particularly the North River Pollution Control Project.**

The large-scale water pollution treatment programs now being implemented by the City and State are expected to result in significant improvements in the quality of the Hudson River between 1974 and 1995. The Federal government has set a target date of the mid-1980's for the commencement of high-quality waste treatment throughout the United States, and through the Federal Water Pollution Control Act Amendments of 1972 has established standards for waste treatment and provided financial assistance to the states for construction of the necessary treatment facilities. The objective of the New York City program of sewage treatment facility construction is to enable the surrounding rivers and bays to meet the strict standards established by the State of New York and Interstate Sanitation Commission.

For the portion of the Hudson River bordering the Study Corridor, these standards are four parts per million of dissolved oxygen (DO), and fecal coliform levels of not more than 200 per hundred milliliters. Achievement of these standards would permit the designated "best use" of the Hudson's waters—that is, "secondary contact recreation, including boating, fishing and other shoreline recreational activity involving limited contact with surface waters." Also, the State of New Jersey will be required to satisfy the Federal standards for waste treatment, which may require upgrading of treatment facilities. These combined efforts are expected to improve water quality throughout the lower Hudson River drainage basin.

In 1974, the two major types of water pollution in the Lower Hudson are pollution from the discharge of domestic and industrial wastes, and deposits of oil, grease, heavy metals and floating debris. At present, the effects of sewage discharge on water quality are more severe than those of the other pollution sources. The extensive program of sewage treatment plant construction now underway is aimed at reducing pollution from this source. Two sewage treatment plants are planned to handle the wastes from Manhattan's West Side which are presently discharged untreated into the Hudson. The North River Water Pollution Control Project, now being constructed in the area of Riverside Park, will treat wastes produced by the West Side area between the northern end of Manhattan and Bank Street. Wastes from the area between Bank Street and the Battery will be pumped to the Newtown Creek Plant in Brooklyn. Both plants are designed for a high quality waste treatment—90 percent removal of suspended solids and biochemical oxygen demand (BOD). That is, the effluent discharged from the plants into the rivers will have only ten percent of the strength of wastes entering the plants. This remaining pollutant material will be decomposed within the receiving waters.

If all wastes generated by the City were subjected to this level of treatment, the water quality of the rivers and bays would improve dramatically, and could be maintained at a high level. Unfortunately, the City's combined sewer system will prevent the continual attainment of good water quality, because sanitary sewage from homes, offices and industries, and storm water are accommodated by a single sewer system. During periods of dry weather, the system carries only the normal domestic wastewater and the water from routine street cleaning operations. The dry weather flow will be transported by the sewers to the treatment plants. However, during periods of rainfall, the storm water will swell the flow beyond the capacity of the treatment plants, and part of the mixed domestic waste flow and storm flow will be discharged directly into the River through the series of sewer outfalls. This problem will be alleviated by mechanical devices called regulators which will divert some of the heavier sewage solids to the treatment plants, while allowing the waste water to flow directly out. These regulators must be carefully maintained in order to assure that they fulfill this function, a task which has proved difficult in the past. In spite of the City's intention to maintain the regulators every two weeks, there will still be a spillover of raw sewage into the River during wet weather periods. This raw sewage will degrade the water quality, particularly in areas close to the sewage outfalls.

It is estimated that separate sanitary and storm sewers would discharge four pounds of BOD (biochemical oxygen demand) per acre inch of rain[73] whereas a combined sewer system would send 38.5 pounds of BOD per acre inch of rain into the receiving waters. Futhermore, an estimated 74.5 pounds of suspended sewage solids are discharged from a combined sewer system, while only 17.4 pounds per acre inch of rain are discharged from a separated system.

The table below illustrates the dissolved oxygen (DO) levels for three main channel locations in 1970 and 1990, in parts per million. The 1970 values were measured, and the 1990 values projected as part of a study for the New York State Department of Environmental Conservation.[74] The 1990 values take into account high quality waste treatment (90 percent removal of BOD) within both Manhattan and the upstream New York and New Jersey communities. These values do not reflect pollution from the combined sewer system during wet weather periods.

Location	1970	1990
River Mile Point 0 At The Battery	3.10 ppm	4.30 ppm
River Mile Point 5 Near 53rd Street	3.35 ppm	4.55 ppm
River Mile Point 10 Near 155th Street	4.15 ppm	4.80 ppm

As part of the same study, the BOD load entering the Hudson from Manhattan was estimated for 1970 and predicted for 1990 under the conditions described above.

Biochemical Oxygen Demand (BOD_{20})	1970	1990
	813,000 pounds per day	158,000 pounds per day

These figures indicate that operation of the new sewage treatment plants in Manhattan and in upstream areas should have significant beneficial effects on the water quality of the Hudson during dry weather periods.

No projection of 1990 fecal coliform levels is available for comparison with the very high levels (as much as 110,000 per hundred milliliters) measured by the New York City Environmental Protection Administration in 1973. However, the Interstate Sanitation Commission has indicated that the proposed New York State standard of 200 per hundred milliliters can be met during dry weather periods, but will probably be exceeded when rainfall causes overflow of raw sewage into the River.

The location of sewer outfalls is very important because wet weather flows will raise pollution levels near the outfalls. The 31 outfall connections along Manhattan's West Side between the Battery and 72nd Street were originally designed to discharge at the pierhead line into the faster-flowing waters of the main channel. Pollutants discharged under these conditions would be more rapidly dispersed and assimilated by the receiving waters. However, over a period of many years, the outfall pipes have deteriorated and broken, causing the sewage to discharge into the inter-pier basins and directly under the piers, where the flow velocities are insufficient to disperse the wastes. At the present time, there is no City plan to repair these outfalls, and if the situation described above continues, then there will be additional deposition of pollutants near the outfalls.

The second type of water pollution in the Hudson which would exist in 1995 is caused by the deposit of oil and grease, debris and heavy metals such as lead. These deposits, while not as threatening to health as raw sewage overflow, nonetheless affect the appearance of the water, its potential for recreational use and the type of habitat provided for marine species. The major sources of oil and grease will continue to be shipping and other waterfront activities requiring transfer of oil and discharge of grease from mechanical equipment. Since shipping activity on the West Side is expected to be very limited in 1995, the chances of oil spills within the Project area are small. However, the River currents will still bring surface oil from other parts of the River basin, and some oil and grease will be washed off street surfaces during rainy periods.

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[73] One inch of rain falling on one acre of land. In an area like Manhattan, which is almost completely covered by impermeable materials, and therefore has little ground absorption, most of the rainfall flows into the sewer system. Source: New York City Environmental Protection Administration.

[74] **Hudson River Water Quality and Waste Assimilative Capacity Study,** New York State Department of Environmental Conservation, December 1970.

At the present time, the major sources of drift debris along the West Side are the deteriorated pier structures. Pieces of wood routinely break away from these structures and float on or near the surface of the water. The larger pieces often remain in the inshore area for some time, and pose a hazard to pleasure craft. The Army Corps of Engineers and the City Department of Ports and Terminals have recently removed some of the most severely deteriorated piers. Although there is no official City position on the continuation of these demolition activities, for purposes of the water quality study, the Project has assumed that those piers which are deteriorated and are not currently used for shipping activities or non-maritime public purposes will be removed in the future, and that the remaining piers will be maintained. If this assumption proves valid in the future, the amount of drift debris will be greatly reduced. If not, deterioration of pier structures over the next 20 years will continue at a rapid rate, necessitating costly debris removal operations and posing a hazard to small boats.

With the anticipated improvement in water quality, the marine habitat provided by the Hudson estuary in the Project area should be capable of supporting more diverse estuarine species, particularly those which require higher dissolved oxygen (DO) levels than exist at present. This will pertain both to the main channel and to the inshore area, although species resident in the inshore area will be limited by the higher BOD levels during storm overflow periods, and by the necessary tolerance for rapid and severe fluctuations in salinity. Bottom-dwelling species like clams may return to the area, although harvesting will probably be prohibited because of danger of contamination. Fishes such as young flounder and sturgeon can also be expected to exist in greater numbers.

A final point which should be mentioned in this discussion of 1995 water quality conditions is siltation. Siltation is a normal, although troublesome, condition associated with estuaries like the Lower Hudson. At present, siltation poses a problem in maintaining clearances within pier basins and along the main shipping channel of the River. Dredging to clear pier basins re-suspends the sewage solids which have settled to the basin bottom. Whatever dredging occurs in 1995 would also have this effect, but the raw sewage waste loads in the basins should be considerably less than at present, and the resulting degradation of water quality from re-suspension of these materials would be less severe.

Probable Impacts of the Alternatives

The material presented above provides a necessary background in the on-going activities which will influence water quality in the Study Corridor during the next two decades. These improvements will be carried out regardless of the decision among the West Side Highway Project alternatives. Furthermore, the implementation of any particular Project alternative would only slightly affect water quality in the Hudson River.

Five water quality factors have been identified as possibly being affected by the Project alternatives. They include the shoreline configuration, sewer outfalls, treatment of bottom material, provision of marine habitat and automotive source pollutants. The order of presentation is important, because the shoreline configuration influences siltation and flow rates, and these factors affect the ability of the water to disperse the pollutants introduced into it. Since the pollutant loads in the main channel and the amounts of pollutants deposited in the inshore area from the sewer outfalls are expected to be low in 1995, the location of the outfalls and the flow rates of the water at points of discharge are important in assessing the retention or dispersion of pollution from raw sewage in the inshore area. This, in turn, affects the nature of the bottom material in the inter-pier basins, which will have greater or lesser amounts of deposition of sewage solids depending upon the amount of dispersion that takes place. All of these factors combine to influence the basic water quality parameters, DO and BOD. The DO levels and the salinity conditions will affect the types and numbers of marine species which are resident in the inshore area.

The one basic condition which, more than any other, will negatively affect water quality is the City's combined storm and sanitary sewer system. None of the alternatives would directly affect the basic operation of this system.

Maintenance, Reconstruction and Arterial Alternatives

In the strictest sense, those alternatives which would do nothing to change the basic conditions which bear upon water quality can be said to have no impacts, either positive or negative. In fact, they would have the effect of continuing situations which negatively impact water quality, particularly that of the inshore area along the West Side. Because of their similarity in this respect, the Maintenance, Reconstruction and Arterial alternatives are discussed together.

These three alternatives would retain the majority of the existing piers, leaving a relatively rough shoreline, interrupted at intervals by finger or box-piers. It is assumed that Pier 26 in Lower Manhattan, Piers 45, 46, 48, 49, 50, 51 and 52 on the Greenwich Village waterfront, and Piers 56, 65, 66, 66-A and 67 in the Chelsea area would be demolished. It is recognized that there are proposals for the use of some of these piers for commercial, recreational and cultural activities. However, no decisions have been made on these potential uses at the time this is written. It is also assumed that the remaining 17 piers between Reade Street in Lower Manhattan and West 42nd Street in Midtown would be given periodic maintenance, and thus would not contribute significant amounts of drift debris to the Hudson's waters in 1995. The illustration here shows the shoreline for the Maintenance, Reconstruction and Arterial alternatives, with the shaded piers indicating those which are assumed to be removed by 1995.

The 17 inter-pier basins expected to exist south of 42nd Street would continue to experience siltation at approximately the same rate as now, and those basins in which shipping activities continue would have to be dredged. Those pier basins which are not dredged would experience additional silt buildup alongside and under the piers and along the silt ridges which would remain where piers were demolished. The additional silt accumulation would produce sealed coves along the shoreline, causing further reduction or complete elimination of the already minimal north-south flow in the inshore area[75].

Neither the Maintenance, Reconstruction nor Arterial alternatives would affect the spacing and discharge points of the sewer outfalls within the Project area. The City Environmental Protection Administration Department of Water Resources has indicated that all of the outfalls below 42nd Street (with the exception of the six outfalls reconstructed through the Battery Park City Project) are thought to be broken, and, therefore, now discharging at various points within the West Side pier basins or directly under the piers. Determination of the exact discharge point of each outfall would require a field inspection. The depths of the outfall pipes usually vary between five and ten feet below mean high water.

Dispersion of pollutants in 1995 under these conditions would be limited by the very low north-south flow rates in the pier basins. The dominant flows would be caused by tidal action and density induced currents in the main channel The relatively quiescent periods resulting from these flow conditions would permit settling out of sewage solids discharged from the outfalls.

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[75] North-south flow rates in the pier basins measured in 1972 as part of this Project ranged from .05 to 0.1 knots, in contrast to main channel flows of 1.5 to 2.3 knots. Actual inshore flow rates may be even less, since these very low measurements are within the normal range of error of the measuring instrument.

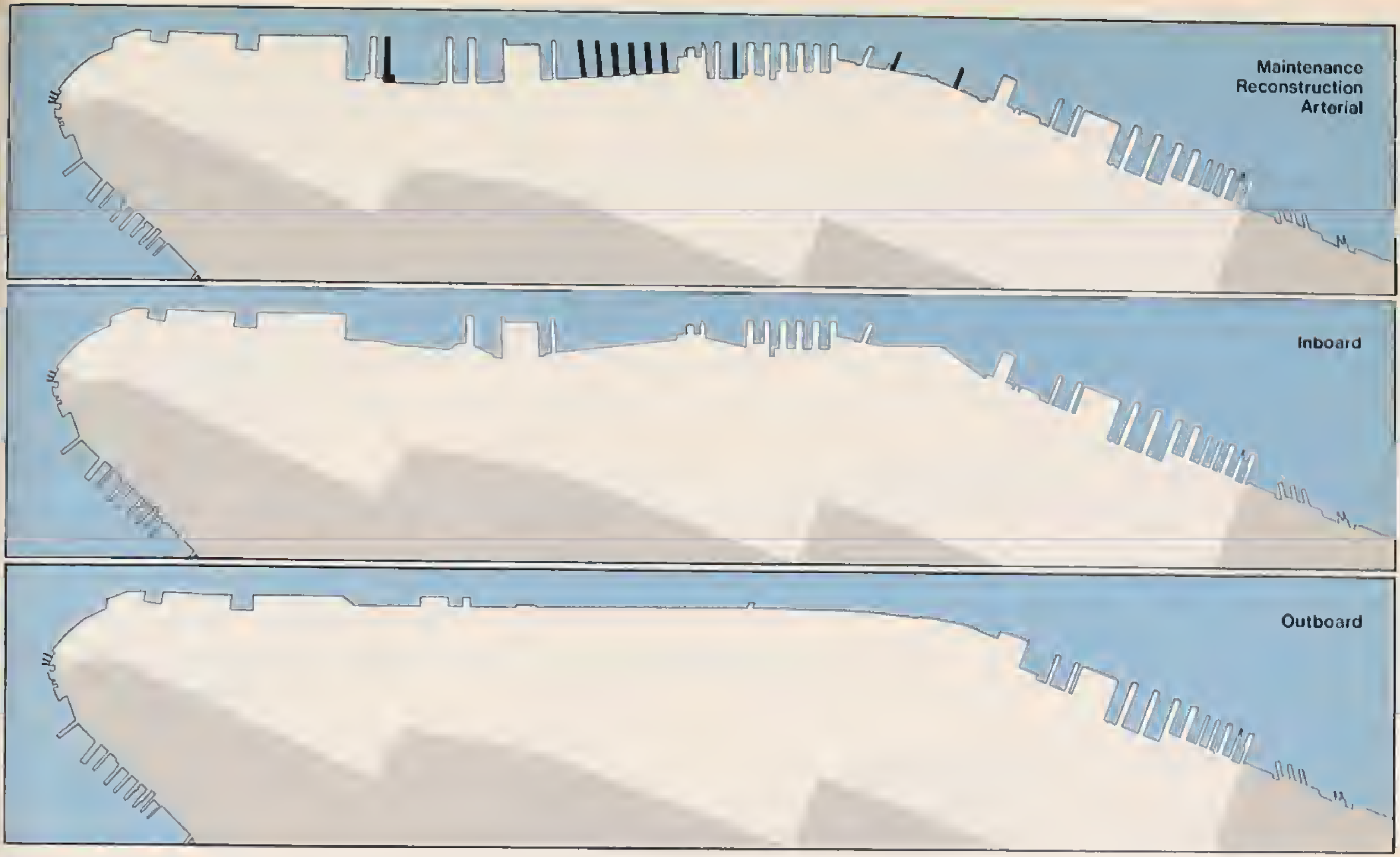

Illustration 111 Proposed Shoreline Configurations

■ Piers to be Removed by 1995

□ Project Study Corridor

North

The bottom material of the pier basins retained by these three alternatives would consist of the existing layers of silt and sewage solids, some additional material deposited before the treatment plants begin operation, and small increments of wet weather sewage overflow after the plants are operating. This material will undergo anaerobic fermentation as long as sewage solids are present, and will release small amounts of methane and hydrogen sulfide gases. This material in its settled state would not contribute appreciably to water pollution. However, if the bottom material were churned up and re-suspended by ships' propellors or dredging operations, the BOD rates in the area would rise. Much of the dissolved oxygen would be consumed by the suspended organic sewage, and odors from the hydrogen sulfide gas might be released into the air for a short time. The bottom material would generally settle out again within a few hours, and would return to its anaerobic fermentation process.

The species inhabiting the inshore area would continue to be those with a tolerance for change in levels of salinity. The Maintenance, Reconstruction and Arterial alternatives, in terms of marine habitat, would continue the east-west tidal flows and rapid fluctuations in salinity within the pier basins. Variable salinity and the raw sewage deposited from sewer outfalls would limit resident organisms to those tolerant of such conditions. Fish, with their great mobility, could move in and out of the basins, as necessary, to find water of suitable salinity and with suitable dissolved oxygen levels. Slower moving creatures, particularly those which dwell along the bulkheads or pier pilings, would be limited to very hardy species capable of withstanding the changes in salinity and the periodic degraded DO levels. Bottom dwelling species like clams and crabs would be those varieties which could withstand both the salinity changes and the periodic fluctuations in the rates of dissolved oxygen caused by the sewage deposits.

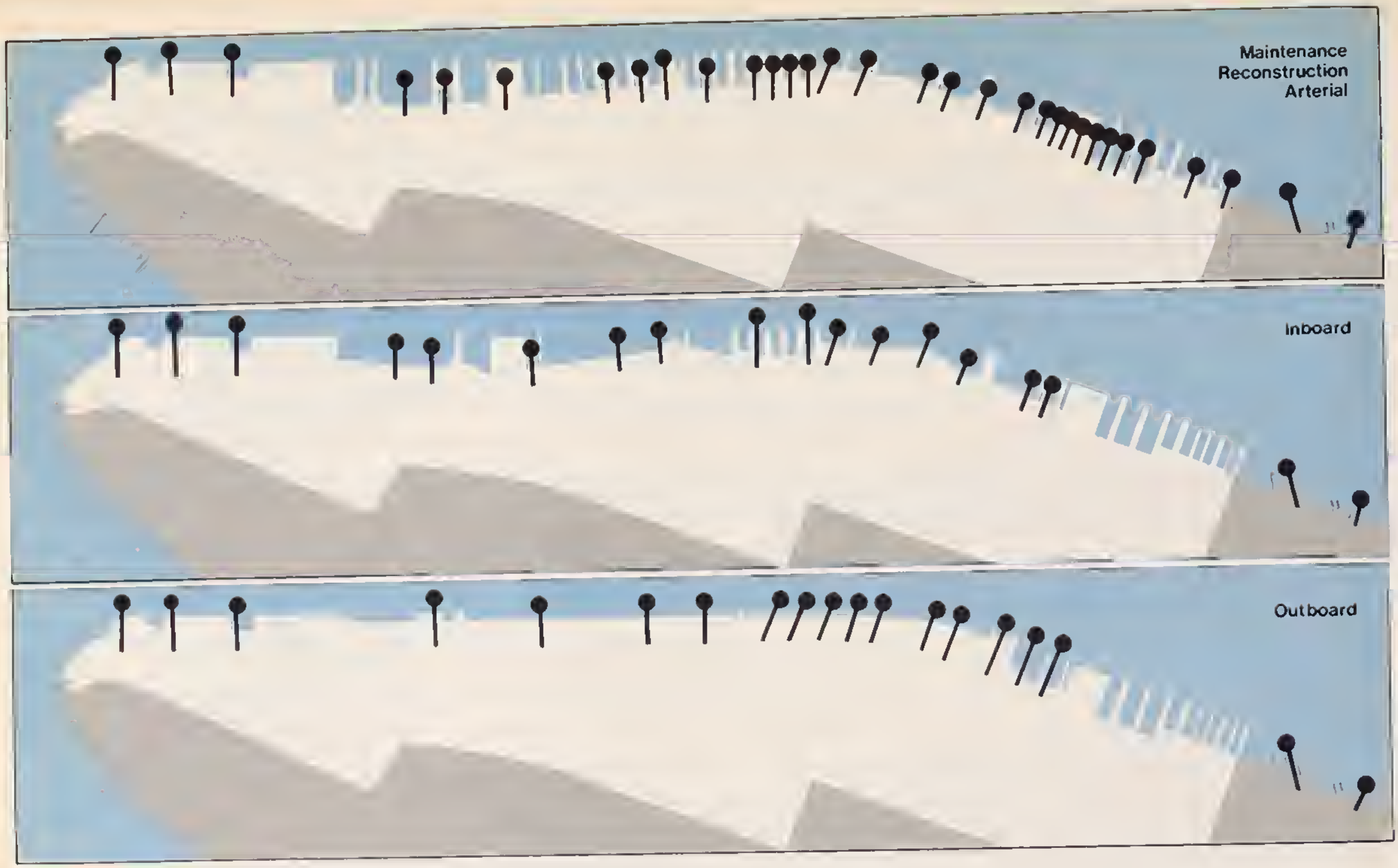

Illustration 112 Proposed Sewer Outfall Locations

—● Sewer Outfall Location

North

Automotive source water pollutants would constitute only a small part of the pollutant matter in the Hudson in 1995, with an extremely small portion of such pollutants attributable to the West Side Highway Project. The Maintenance, Reconstruction and Arterial alternatives would be subject to icing conditions in the winter, necessitating salting to clear the roadway surfaces. The salt and chemical additives would eventually be washed from the roadways, and some of this material would overflow through the sewer outfalls into the River. In the same manner, small quantities of oil and grease would be deposited into the water, though most of these pollutants would come from other sources. The phasing out of lead additives in gasoline is expected to completely eliminate lead deposits on roadways by 1995. Therefore, lead entering the water would probably come from other than automotive sources.

Inboard

Construction of the Inboard alternative would produce a shoreline configuration which could be characterized as partially smoothed. Piers, with the exception of Pier 34, would be removed and landfill would be placed between the end of the Battery Park City landfill and Pier 40. North of Pier 40, landfill would be placed to the southern edge of the Gansevoort Marine Transfer Station. This fill would extend outward from the existing bulkhead for 120 feet at the northern edge of Pier 42, gradually increasing to 192 feet at the southern edge of the Marine Transfer Station site. From the north side of the Marine Transfer Station, fill would be placed to Pier 57. Piers 57, 58, 59, 60, 61, 62 and 64 would be retained, with no fill placement in that area. North of Pier 64, landfill would be placed, and would extend to south of Pier 76,[76] as illustrated. The expanded inter-pier areas with landfill shorelines would probably experience slightly improved north-south flow rates within the basins. However, north-south exchange between the basins would still be blocked, meaning that the rate of siltation most likely would not diminish appreciably.

The Inboard alternative would affect 18 sewer outfalls between Reade Street and West 43rd Street. At several locations, outfalls would be combined; one would be relocated to the north of its present position, and ten would be extended in place. Those placed in landfill sections would extend to the edge of the fill slope, while those not affected by landfill would be extended to the pierhead line. The relocated and extended outfalls would discharge at a depth of approximately 35 feet below mean high water. Pollutant dispersion from those outfalls extended to the pierhead line would be improved substantially, although some of the sewage solids could be carried into neighboring pier basins. Outfalls extended to the edge of the landfill would have slightly improved dispersion, but the flows within those reconfigured pier basins would still be dominated by east-west tidal flows, and some settling out of sewage solids could be expected in the pier basins.

Construction of the Inboard alternative would remove the bottom material wherever landfill is placed, but the rest of the bottom material in landfilled basins, and that in areas not affected by landfill, would be subject to the conditions described for the Maintenance, Reconstruction and Arterial alternatives. As long as sewage solids were present, small amounts of methane and hydrogen sulfide gases would be released to the air. Also, if bottom materials were re-suspended, the BOD rates would rise rapidly, dissolved oxygen would be consumed by the suspended organic sewage, and odors from the hydrogen sulfide gas might be released into the air for a short time. This material would eventually settle out again, and return to its anaerobic fermentation process until re-suspended.

The removal of some anaerobic material would be a slight improvement over the Maintenance, Reconstruction and Arterial alternatives, but would not alleviate the basic problem. In addition, the material removed would have to be disposed of, possibly having negative effects on some other area. Disposal and the treatment of the bottom material during construction, when the danger of fairly continual re-suspension would exist, are discussed in the construction impacts portion of this section.

The marine habitat provided by the Inboard alternative would be essentially the same as that of the Maintenance, Reconstruction and Arterial alternatives. Dissolved oxygen levels in the reconfigured pier basins might be somewhat higher, but this difference would probably not affect the types of resident species. The placement of riprap shoreline along the landfill edges would provide numerous crevices and holes as dwelling places for marine species. However, the frequent salinity changes would limit these to the hardy varieties, and thus the diversity of species would probably not be affected.

The Inboard would reduce automotive source pollutants because part of the roadway surface is covered, and would not require salting in the winter. Moreover, covered portions would not be subject to washoff of oil and grease during rainfall periods. There would be some tracking of salt on tires into the covered sections, but this would be relatively slight. Covered sections would also require periodic cleaning, and special attention has been given to the diversion of detergents used in these cleaning operations to assure that they are discharged into pipes leading to the interceptor sewer, and to the sewage treatment plants. Provided that the relatively infrequent cleaning operations were undertaken during dry weather periods, there would be no discharge of detergents to the River.

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[76] More specific information on landfill is given in the **West Side Highway Project Design Report.** Minor differences in the shoreline would result from the alternative Holland Tunnel one-corridor interchange, and the Lincoln Tunnel 35th Street interchange.

Outboard
The Outboard alternative would provide a continuous landfill shoreline from the end of the Battery Park City development to West 39th Street in Midtown. The shoreline edge would be located from 180 to 200 feet inside the pierhead line. This shoreline might have several landfill projections extending to the pierhead line to accommodate facilities such as the ventilation building for the Holland Tunnel, a quay-side berthing space for the maritime school ship *S.S. John Brown II*, a short pier for the Gansevoort fireboat, and a space for the relocated Marine Transfer Station. These projections would not significantly impede the north-south flow rates along the edge. Rates would approximate those of the main channel, that is from 1.6 to 2.6 miles per hour, depending upon tidal flow.

The removal of the inter-pier basins below 39th Street would also eliminate settling areas for the fine silt particles carried by the main channel. Only minimal siltation would occur along the Outboard edge, the flow rates being too rapid to allow settling. As a result, siltation in other parts of the harbor may be more rapid. The alternative edge treatments under consideration for the landfill sections would have basically the same effect upon flow rates and siltation. Neither the bulkhead edge, constructed of poured concrete, and similar in form to existing West Side bulkheads, nor the gradually sloping rock-covered shoreline commonly referred to as riprap, would attract more silt or be superior in terms of improving flow rates.

Construction of the Outboard alternative would relocate the discharge points of all sewer outfalls between Reade and West 43rd Streets. In three cases, several outfalls would be combined, and these and the remaining outfalls would be extended to discharge at the edge of the landfill, at a depth of approximately 35 feet below mean high water. Dispersion of pollutants from these outfalls would be greatly improved over that achieved by other alternatives. Outfalls would discharge into the water with flow rates near or equal to those of the main channel, which would result in more rapid dispersion and assimilation than would be the case with the other alternatives.

The Outboard calls for a more complex treatment of the organic bottom material. The bottom material would first be excavated in the area where the highway and transitway would be built. This material would be placed on the inboard side, covered, and allowed to settle while clean fill was placed to accommodate the highway structure. After the clean fill had settled sufficiently to allow construction, a portion of it would be removed and piled up on the inboard side over the organic material, and construction would proceed in the landfill cut. When construction was completed, the clean fill would be evened out over the surface of the landfill area, covering the highway and transit facility, and the organic material, as discussed in the construction impacts section.

Once the landfill was in place, no further water pollution from the bottom material would result. However, the nature of the anaerobic fermentation process is such that the sewage might continue to decompose at a slow rate for a number of years. If it were determined by more complete studies that this would be the case, small vent pipes could be provided at regular intervals to allow the methane and other gases to escape; these could be constructed in such a way that the gases would be vented away from human activity areas.

The marine habitat provided by the Outboard would closely resemble that of the main channel. Dissolved oxygen levels would be somewhat higher than under the other alternatives and the levels would be subject to less fluctuation. Pollutant materials would be more rapidly dispersed and there would be little settling out of sewage solids or silt along the shore. Changes in salinity along the Outboard edge would be much less severe than under the other alternatives. The layering of fresh, brackish, and salt water which characterizes the main channel would also apply to the Outboard shore. The rise and fall of these layers caused by tidal action would be gradual enough to permit shore migrations along the edge by species requiring a stable habitat. As with the Inboard, a riprap edge would provide a greater variety of dwelling areas, and could attract more species, both those resident along the edge, and fishes which feed on these creatures.

The Outboard alternative has the major portion of the mainline roadway partially or completely covered, and thus would greatly reduce automotive source pollutants. The salt tracked in would be washed out through the special drainage pipes provided from the roadway through the landfill to divert cleaning detergents to the interceptor sewer. Provided that cleaning operations were done in dry weather, none of the pollutants being washed out of the covered sections would find their way to the Hudson River.

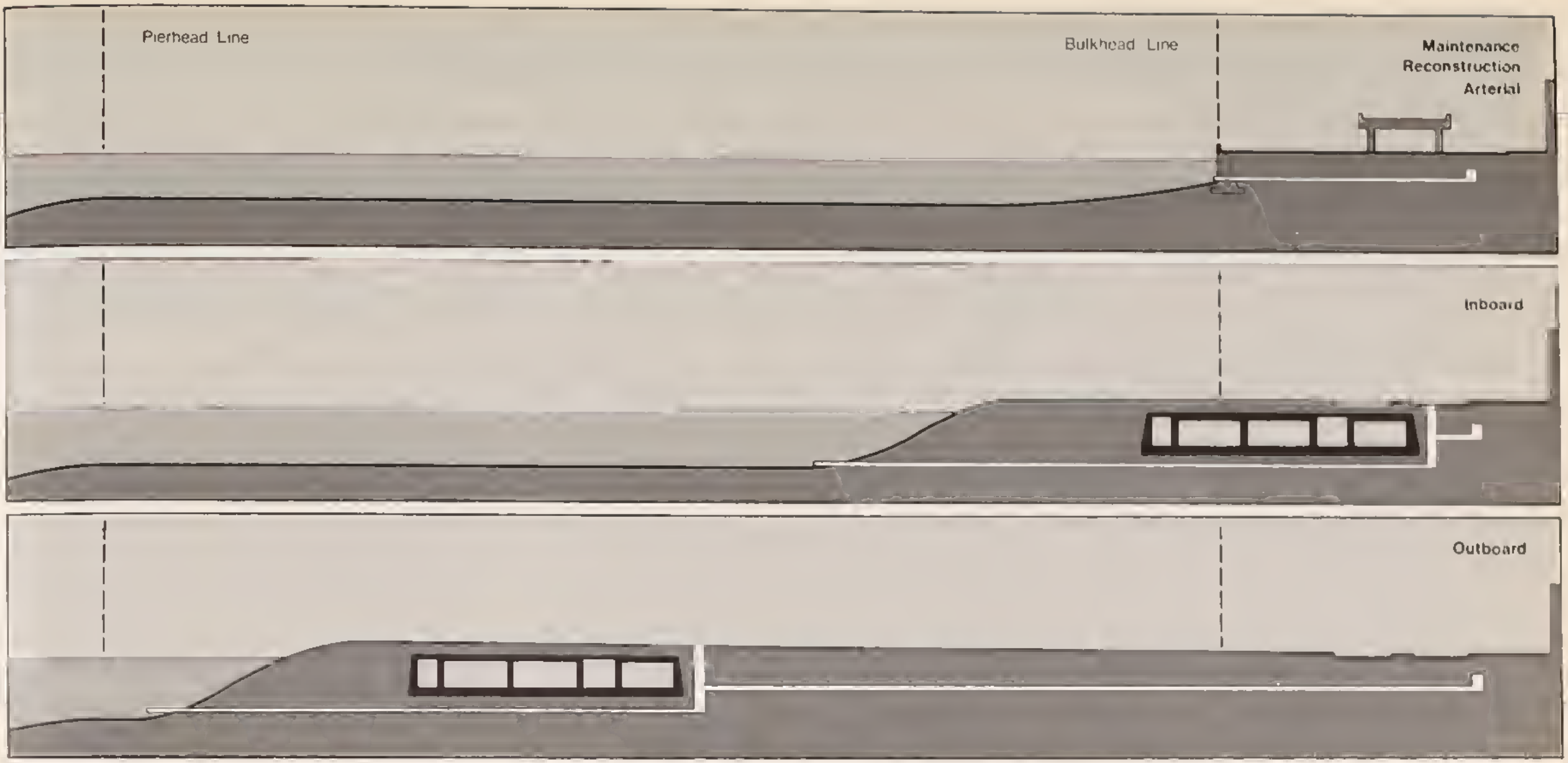


Illustration 113 Proposed Sewer Outfall Cross Sections

Summary

No alternatives considered would materially affect the achievement of the prescribed water quality standards for the entire lower Hudson River and New York Bay. Of the five Project alternatives under consideration, the Outboard alternative would have the best effects on water quality, because it would produce the greatest improvement over 1995 conditions. The Outboard implementation would reconfigure the West Side shoreline, providing a smoothed edge and, consequently, improving flow rates, and dispersion of pollutants. Silt buildup along the shoreline would be minimal, and although this would benefit the West Side waterfront, siltation might occur at a more rapid rate in other parts of the harbor as a result. The type of marine habitat provided by the Outboard would benefit from the improvements in dissolved oxygen levels and from the more gradual fluctuations in salinity along the Outboard edge, and, therefore, should be able to support more varieties of estuarine species in greater numbers.

The Inboard alternative would offer far fewer benefits than the Outboard, largely because of the retention of finger-pier structures within the Project area. Partial smoothing of the shoreline in the expanded inter-pier basins, and relocation of sewer outfalls would produce small improvements in flow rates and in pollutant dispersion. However, the pier structures retained by the Inboard would continue to block any significant north-south flow of water along the shore. Water in the coves created by the finger piers would be subject to low flow rates and quiescent periods, and there would be continued settling out of silt and of sewage solids within these areas. The marine habitat provided will not be significantly improved. Water quality would be subject to periodic degradation by the re-suspension of the organic bottom material remaining on the bottoms of the pier basins.

The Maintenance, Reconstruction and Arterial alternatives would have no effects, either positive or negative, on the basic water quality conditions in 1995.

Impacts on Public Facilities and Utilities

In New York City, public facilities and utilities are so numerous and interrelated that the services they provide touch almost every aspect of life. From the visible public buildings and institutions throughout the City, to the network of subsurface utilities hidden beneath the streets, this vast urban infra-structure supports the public health, welfare and safety. For this reason, any disruption of services could cause far-reaching consequences for the City, and hardships for its citizens.

The Steering Committee adopted one goal and one policy addressed to potential problems.

- **Minimize disruption, dislocation, and other social and economic costs which may occur from reconstructing the highway.**

- **Develop alternate corridor plans consistent with the City's ability to provide essential public services, especially major utility needs.**

This discussion concerns the probable effects that each of the alternatives would have on religious, health, educational, safety, and solid waste facilities and sewer, water and energy utilities.

This Project made a detailed study of all landmarks and historic sites within the planning area. These include the properties which enjoy protected legal status by either appearance on the National Register of Historic Places, or designation as New York City Landmarks, or both. In addition, other properties which presently enjoy neither Federal nor local legal status, but are considered "architecturally significant" were included. This category consists of those properties currently proposed for National Register or City Landmark designation, as well as other noteworthy buildings at least 30 years old, as identified by local communities, special interest groups and public agencies.

It was found that none of those landmarks or historic sites would be directly impacted by any Project alternative. The details of this work are contained in the West Side Highway Project **Report on Landmarks** (No. 5.16, June 1973).

Study Corridor Facilities

At present, the Corridor is adequately served by a wide range of public facilities. Because of shifts in manufacturing and residential land uses over the past decade, some of these facilities are underutilized, and have excess capacity to accommodate future growth. Other facilities are operating at capacity, but have become inadequate by virtue of obsolescence. The status of these facilities and their relation to the existing Highway are summarized below.

■ **Religious** Numerous religious facilities exist in all of the Corridor communities. However, none would be physically affected by Project alternatives. The Church of Saint Joseph, a small Catholic church on Cedar and West Streets in Lower Manhattan, is situated adjacent to the existing West Side Highway.

■ **Health** There are six general care hospitals and a range of outpatient clinics distributed through the Corridor communities. Only one facility, the Bayview Rehabilitation Center, is located adjacent to the existing West Side Highway. This 200-bed New York State drug rehabilitation center is situated at the northwestern corner of 20th and West Street in Chelsea.

■ **Education** One education facility is located in the proximity to the Highway in the form of the Maritime Trades High School floating annex, the *S.S. John Brown II*, currently berthed at the Morton Street Pier. In adjacent Corridor communities, there are six elementary schools, three intermediate schools, six high schools, and two special schools for children with learning handicaps. Plans for additional school capacity include the construction of one intermediate and two elementary schools in the vicinity of Battery Park City, where no schools currently exist. Also planned are additions to or replacement of five existing schools in the Greenwich Village, Chelsea and Clinton portions of the Corridor, and the construction of Manhattan Community College in Lower Manhattan.

■ **Public Safety** Of the 13 fire stations which serve the Corridor area, one would be directly affected by Project alternatives—Marine Fireboat Company 2, based at Pier 53. Six police precincts are located throughout the Corridor. However, none of these facilities or services would be disrupted.

■ **Solid Waste** The Gansevoort solid waste disposal complex, consisting of the incinerator, marine transfer station and storage facilities, is located on the Hudson River between Piers 52 and 53. This facility serves as a solid waste terminal for the entire Corridor area and is the only disposal facility currently operating on the Lower West Side.

Illustration 114 Existing Public Facilities in the Project Study Corridor

Ⓕ	Fire Station
Ⓟ	Police Station
⊕	Hospital
○	Other Major Health Facility
□	Public Schools
■	Private Schools
◪	Higher Education Facility
	North

Tunnels

There are major tunnel connections to Manhattan under the Hudson River. These include two tunnels for the PATH transit system, the Penn-Central railroad tunnel, and the Lincoln and Holland Tunnels. Careful consideration was given to these facilities for all alternatives, and none would be impacted during construction. Traffic flow at the entrances and exits to the Lincoln, Holland and Brooklyn-Battery Tunnels would be affected in varying degrees as described in the section on construction. The Inboard and Outboard alternatives include design for protection of these tunnels as necessary.

Study Corridor Utilities

Within the Corridor, major utilities including combined sewers, water mains, gas, steam and electric lines, and telephone cables either terminate at the waterfront or run parellel to the Hudson River buried under West Street-Twelfth Avenue.

■ **Combined sewers,** including catch basins and manholes. These sewers are of differing dimensions, ranging from eight inches in diameter to five by eight foot rectangular brick sewers.

■ **Interceptor sewers,** including regulator and diversion chambers and manholes. Two interceptor sewers will serve the Corridor, taking the dry weather flow and a small portion of the storm water flow water. The excess flow during storms is discharged through the outfalls into the river via the regulator chambers. One interceptor sewer system serves the drainage area between Bank Street and the Brooklyn-Battery Tunnel. The flow is discharged through a 78-inch and 72-inch diameter concrete pipe to the Manhattan Pumping Station located in the Bellevue Medical Center area. The other Interceptor sewer system serves the drainage area extending northward from Bank Street to the new North River Treatment Plant at 145th Street. The flow discharges through a 30-inch diameter pipe at Bank Street. By the time it reaches 42nd Street, the size of the interceptor has increased to a six by eight foot box sewer.

■ **Combined sewer outfalls** are located at intervals along the corridor at each regular chamber. The outfall discharges excess storm water into the River. In each regulator chamber, a tide gate is inserted to protect the local combined sewer collection system from flooding. The outfall sizes range from 48 inches in diameter to six by eleven foot box sewers

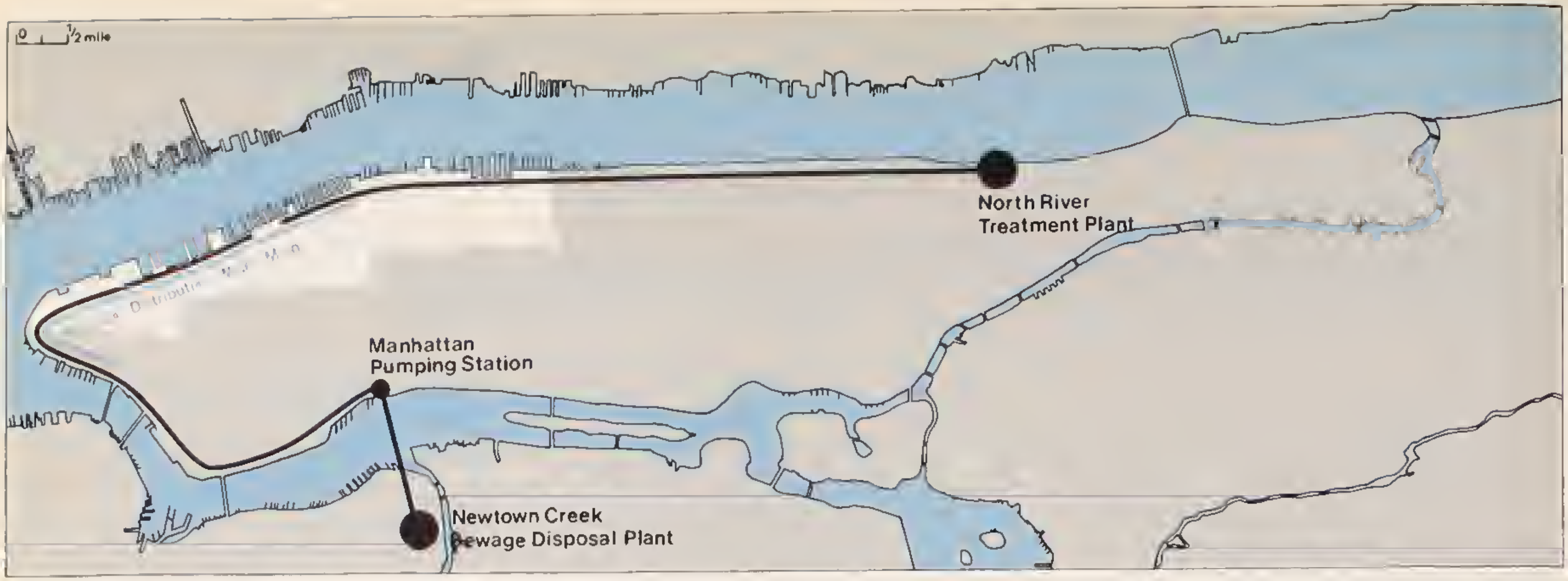

0 ½ mile
North River Treatment Plant
Manhattan Pumping Station
Newtown Creek Sewage Disposal Plant

Illustration 115 Planned Interceptor Sewers and Water Treatment Facilities

▬ Interceptor Sewer

● Treatment Plant

— Water Line

▭ Project Study Corridor

North

■ **Transmission water tunnel** currently serves Lower Manhattan. This water line runs in a north-south direction and crosses the East River to Brooklyn at approximately Jackson Street. From this point, a shaft to the tunnel supplies a network of distribution mains which serve the entire area, extending all the way to the West Side. In anticipation of rising demand for water in Lower Manhattan, a new deep rock tunnel has been proposed for the West Side by the City Department of Water Resources. This tunnel would originate at New York City reservoirs in upstate New York and extend down Manhattan Island at a depth of between 200 and 300 feet. As currently proposed, the tunnel would be located beneath West Street and would terminate at Canal Street or some point further south.

■ **Water main systems** in the Corridor are both low and high pressure and run near the surface, connecting to the existing transmission water tunnel at strategic points. The high pressure system provides fire protection water, while the low pressure system services facilities and buildings located on either side of West Street. The sizes vary from six to 30 inches in diameter. Included in the system are valve chambers, gate valves, pressure reducing valves and hydrants. A new 72-inch diameter distribution water main is currently planned to draw water from the proposed new deep rock tunnel and supply it to areas of rising demand. This main would start at the East River and follow the perimeter of the Island around the Battery proceeding north under West Street and ending possibly in the West 20's.

- **Gas mains**, including manholes, regulators, drip traps and pumping standpipes are located near the East property line in West Street. The size of gas mains in the corridor are 4 and 6 inches in diameter, with a medium pressure classification.

- **Steam lines** coming from Rector Street, King Street and 15th Street terminate in West Street. There are no steam lines running the length of the Corridor.

- **Electric power lines** are located throughout the Corridor to provide power to both sides of West Street and the waterfront facilities. In addition, there are two ten-inch diameter steel pipes crossing the River. One of the pipes carries a 345 Kv cable while the other pipe will be used at a future date.

- **Telephone lines** are located throughout the Corridor, including splice chambers and terminal boxes.

- **World Trade Center facilities** for air conditioning are located under West Street and connect to a pumping station near the River. These facilities include two 60-inch steel pipes, two 20-inch concrete pipes, a 36-inch ductile iron pipe and an electric duct bank.

Probable Impacts of the Alternatives

These existing public facilities and utilities are affected to some degree, ranging from minor to major, by either the existing West Side Highway or the proposed alternatives. Project staff have met regularly with City officials responsible for each facility and utility in order to determine existing problems and future needs. Detailed engineering and architectural work was completed in cases where direct impacts necessitated relocation or interruption of service. For alternatives where extensive new development may occur, projection of future public facility and utility needs was especially difficult, owing to the lack of any specific development program. In this situation, efforts were made to assume public facility requirements which would support a range of development possibilities.

Maintenance

Under the Maintenance alternative, the existing West Side Highway would be repaired and reopened, and then serviced with continued periodic maintanance. No major adverse impacts are expected on existing facilities and utilities as a result of this alternative, other than those that currently exist. The existing Highway foundations would act as a constraint on the proposed expansion of existing utility systems under West Street-Twelfth Avenue.

Reconstruction

Relocation of existing utilities would be limited to those areas where new structures or modified alignments would be required. In all cases, the relocations of water, gas, sewer, electric and telephone lines would be accomplished without more than a few hours of service disruption. Construction of a new Midtown interchange at 57th Street would require modification of the future use of Pier 99 as a fuel depot for the Consolidated Edison generating plant at 59th Street. This also would be accomplished without service interruption.

Arterial

The Arterial alternative proposes the demolition of the existing West Side Highway and the reconstruction of West Street-Twelfth Avenue as a surface street. A transitway would also be constructed under the new Arterial from the World Trade Center to 22nd Street. Then it would continue under Eleventh Avenue, or follow the arterial right-of-way under Twelfth Avenue.

Most of the impacts on utilities would be associated with the construction of the underground transitway. Those existing utilities that would be permanently located above the transitway would have to be temporarily supported during construction of the transitway tunnel. The sewer outfalls to the River in West Street would have to be dropped under the transitway and the sewage carried by gravity to an outfall structure at the pierhead line.

In Eleventh Avenue, there is a critical area between 23rd Street and the transitway tunnel entrance at 30th Street, where the transitway occupies the major portion of the space below street level. The existing combined sewers would have to be replaced by two sewer lines on each side of the street. The water and gas mains, electric duct banks and telephone cable would be relocated either in the transitway roof slab or above the slab. The transitway alignment and profile would be such that it will not affect the interceptor sewer. The transitway would cut the combined sewers in Tenth Avenue. Those combined sewers would be relocated down Dyer Avenue via 41st and 42nd Streets.

If the transitway were located in Twelfth Avenue rather than Eleventh Avenue north of 23rd Street, utility relocations would involve the interceptor sewer between 22nd and 25th Streets, and one additional sewer outfall.

Inboard

Although major waterfront facilities such as Pier 40 would be preserved by this alternative, the Gansevoort Marine Transfer Station, the Chelsea Piers, and religious, education, sanitation and safety facilities would be disrupted temporarily. Relocation of public utilities to accommodate construction of a new highway and transitway would be more intense than for the Maintenance, Reconstruction or Arterial alternatives.

Facilities Impact on the Morton Street Pier in the West Village would mean a temporary modification in the berthing for the Maritime Trades High School ship S.S. *John Brown II*, which is currently moored at the facility. The school ship could be moored closer to the pierhead line on the Morton Street Pier, or could be moved to another pier on a temporary basis. Under this alternative, the existing Gansevoort incinerator plant would also be eliminated and would be functionally replaced, as discussed in the section on relocation. The marine transfer portion of the complex would remain intact, with only temporary interruptions to normal operation due to highway construction and provision of access roads. Similarly, access to the Marine Fireboat Company 2, based at the Bloomfield Street Pier, would be interrupted temporarily.

Utilities The relocation of public utilities which would be required for the Inboard alternative is discussed in terms of three areas of the Corridor, starting in Lower Manhattan.

- Brooklyn Battery Tunnel to Harrison Street

1 The 78-inch interceptor sewer between Cedar Street and Morris Street, for a distance of 1500 feet.

2 Air conditioning facilities under West Street at the World Trade Center.

3 Water, gas, steam, electric, and telephone utilities at the Battery Parking Garage.

4 Water, gas, electric and telephone utilities in West Street between Liberty and Vesey Streets.

5 Provision would be made for a new 72-inch diameter water main on the east side of the highway right-of-way.

- Harrison Street to Horatio Street

1 Outfall sewers at Vestry, Clarkson, Bank, Jane and Bethune Streets.

2 Combined sewers at Canal, West 10th and Clarkson Streets, and at the Holland Tunnel Plaza.

3 High and low pressure water mains at Morton Street and Pier 40.

4 Electrical cable at Moore Street.

5 Electrical, gas and telephone utilities at Pier 40.

- Horatio Street to 42nd Street

1 Outfall sewers at Gansevoort, 14th, 17th and 23rd Streets.

2 Combined sewers between 23rd Street, the northern terminus of the transitway and the Lincoln Tunnel Plaza.

3 High and low pressure water mains between 17th and 33rd Street and the Lincoln Tunnel Plaza.

4 Lincoln Tunnel Plaza pumping stations.

Impacts on the City interceptor system feeding the North River Treatment Plant would be limited to the relocation of regulator chambers and sewer outfalls mentioned above. The utilities that service the Marine Transfer Station at Gansevoort Street would be maintained, temporarily supported, and incorporated in the roof of the transitway and highway structure. At the Chelsea piers, the existing outfalls would be consolidated, and a single outlet outfall relocated at 23rd Street and Twelfth Avenue.

If the transitway were to be continued in West Street-Twelfth Avenue instead of Eleventh Avenue north of 23rd Street, then the same utility relocations that were described with the Arterial alternative would be required. In addition, a combined sewer serving the Lincoln Tunnel facilities and a combined sewer serving Pier 81 would have to be relocated and service maintained during construction.

Outboard

The Outboard alternative highway and transitway would be depressed and covered in landfill near the pierhead line for most of their length, except in Lower Manhattan, where they would follow the right-of-way of West Street. Since all of the piers south of 37th Street would be replaced by landfill in this alternative, overall impacts on existing public facilities on the waterfront would be greater than for the Inboard alternative. However, impacts on existing utilities would be the same as for the Inboard in Lower Manhattan, but reduced for most of the rest of the Corridor.

Facilities Each of the public facilities adjacent to the existing Highway would be affected by this alternative. Relocation berths for the S.S. *John Brown II* and the Marine Company 2 Fireboat would also be required on a permanent basis. These vessels could be moored in a quay-side docking arrangement near their present locations. Both the Gansevoort Destructor and the Marine Transfer Station would be directly impacted, and would require relocation or functional replacement as described in the relocation portion of the impacts section.

Utilities The Outboard impact on existing utilities between the Brooklyn-Battery Tunnel and Harrison Street would be the same as for the Inboard. However, north of Harrison Street, the number of utility relocations would be slightly reduced and tied directly to the reconstruction of West Street-Twelfth Avenue, rather than the mainline highway, and to the placement of offshore landfill.

■ Harrison Street to Horatio Street

1 Outfall sewer at Vestry, Clarkson, Bank, Jane and Bethune Streets.

2 Combined sewers at the Holland Tunnel Plaza.

3 Oilostatic electrical lines at Moore Street.

While the Outboard alternative would eliminate the need to relocate or maintain existing utilities serving Pier 40 in this area, the relocation of outfall sewers would entail the additional cost of extending these lines through the new landfill area on pile supported platforms.

■ Horatio Street to 42nd Street

In this area the impact on existing utilities would be similar to the Inboard alternative, involving the extension or relocation of combined sewer outfalls at Gansevoort, 14th, 17th and 23rd Streets. The utilities that service the Gansevoort Destructor and Marine Transfer Station, and the Chelsea Piers would be terminated rather than maintained, thus reducing disruption costs during the construction period. In addition, the same relocations that occur with the Inboard alternative at the 30th and 35th Street Lincoln Tunnel interchange options involving water mains and pumping stations would also be undertaken with the Outboard plan. If the transitway were to continue in West Street-Twelfth Avenue instead of Eleventh Avenue, then the utilities in Twelfth Avenue, at the Lincoln Tunnel, Pier 81 and 23rd Street would be relocated as described for the Inboard alternative.

Summary

The five alternatives vary widely with respect to the number of existing **public facilities** directly impacted, ranging from none for the Maintenance, Reconstruction and Arterial, to two with the Inboard and four with the Outboard. Relocation proposals for the Gansevoort incinerator, Marine Transfer Station, Marine Fire Boat Company 2, and the *S.S. John Brown II* are included in the relocation discussion. The Outboard scheme is the only alternative which would have a significant effect on future, as well as existing public facilities. Although the general type and magnitude of the additional facility requirements has been estimated in relation to existing capacities and possible new development, no specific cost estimates are available.

In terms of existing **public utilities**, the Maintenance alternative would have the least impact, while the Inboard would have the greatest. The Reconstruction and Arterial alternatives without a transitway are considered very similar, necessitating only minor relocations with little or no interruption of services. If a transitway is constructed as a part of the Arterial alternative, temporary impacts would be more severe. Both of the interstate proposals would involve major utility relocations, and are very similar in the area between the Brooklyn-Battery Tunnel and Harrison Street. However, at this point the two proposals follow different alignments, resulting in a reduction of impacts with the Outboard proposal. The Outboard alignment bypasses the congested utility network under West Street-Twelfth Avenue, and would eliminate the need to maintain service to waterfront facilities during the construction period. At the same time, this alternative would require the extension of outfall sewers through the new landfill area to the Hudson River.

Displacement And Relocation

Among the most obvious effects, and frequently the harshest effects, of an urban transportation project are the social and economic dislocation and disruption which it may cause. Many projects have been very disruptive because of the many people who have been physically removed or separated from their families, friends, jobs or neighborhoods. Businesses and industries have been moved to new locations, and in some instances have gone out of existence because their natural market was eliminated or significantly changed. People and businesses left behind often have found their lives and activities changed in ways beyond their control.

The Steering Committee recognized this potential and adopted as one of its goals:

- **Minimize disruption, dislocation and other social and economic costs which may occur from reconstructing the highway.**

Additionally, the Steering Committeee adopted as a policy:

- **Provide equitable compensation and assistance to persons and businesses displaced and/or relocated as a result of reconstructing the highway.**

Locating a new transportation facility so as to minimize the number of displacements is one of the most challenging problems facing the urban planner. This Project has taken advantage of the physical configuration of the Study Corridor—deteriorated and abandoned piers and headhouses, underutilized industrial and commercial space, warehousing and changing residential patterns—to develop a set of alternatives sensitive to the expressed preferences of West Side communities. In fact, the West Side Highway Project is unique among urban planning efforts of comparable size and potential impact, in that the numbers of potential residential, commercial and industrial displacements are extremely small.

It is emphasized here that a detailed relocation plan will not be developed until after one of the alternatives is selected for implementation. The estimated displacements are presented here to help the public understand the possible consequences of the various Project alternatives, and to assist in choosing among them. The number of relocations ranges from none with the Maintenance and Arterial alternatives, to as many as 118 residential units, or as many as 101 commercial enterprises, with the Inboard and Outboard proposals. Because the New York State Department of Transportation conducts in-depth interviews with all people who would be displaced, after the selection of a particular alternative, and because the new facilities would be built in sections, one at a time over a period of years, any affected people would not have to move their homes or businesses for a period of from one to several years after one of the proposals were approved for implementation.

A block-by-block survey of property was conducted during 1972, and regularly updated throughout the planning period into 1974. In some areas, particularly those involving interchanges, building-by-building surveys were conducted. For certain types of displacements, more wide-ranging surveys and inspections were made or preliminary plans developed. Detailed information is available at the Project office or the New York Department of Transportation office in the World Trade Center.

In the following discussion, conclusions that relocations could be effected successfully are based upon property availability at the time the surveys were completed, and mean that relocations could be carried out largely within the Corridor area. While drastic changes in property availability are not expected to occur in a short time, necessary relocations would be made on a case-by-case basis at the time that they actually occur. Importantly, when each dislocation occurs, the family or business affected has the choice of relocating in space found as part of the detailed relocation planning process, or choosing its own future location. This is particularly important as it relates to dislocations involving trucking firms, freight forwarders and freight consolidators. These firms have been undergoing a regular attrition on the West Side and this trend is expected to continue, as discussed in the Project **Report on Trucking Activities on the West Side of Manhattan** (No. 5.15, June 1973). Dislocation might hasten the trend toward moving out of the Central Business District.

The following discussion presents estimates of the numbers of displacements which would result from each alternative, the available State compensatory programs and an assessment of the 1973 real estate market for decent, safe and sanitary replacement dwellings in a comparable price range. Certain facilities which are uniquely important in the Study Corridor are given a more detailed treatment, in terms of where they would be relocated if displaced by an alternative. All other relocations would be carried out under the standard procedures discussed later in this section. Because the alternative program packages presented in this Environmental Impact Statement have not been through the process of final design, it is impossible to pinpoint the exact potential final displacements at this time. However, these data accurately portray the New York State Department of Transportation's best estimates of the relative amount of relocation necessitated by each alternative.

The displacement data are presented for each alternative. The impacts of the Outboard are presented before those of the Inboard for purposes of continuity and clarity. Since the Outboard would completely displace some public facilities, whereas the Inboard would take only a portion of the same facilities, this presentation is clearer if the total displacement is discussed before the partial displacement.

Effects on Private Properties

In summary, the probable impacts of the alternatives on housing and commercial properties are as follows.

Maintenance and Arterial
Neither of these alternatives would cause any displacement of homes or commercial properties.

Reconstruction
This alternative would displace four buildings and relocate 12 commercial enterprises.

Outboard
The Outboard alignment, with a two-corridor interchange at the Holland Tunnel and a 30th Street corridor interchange at the Lincoln Tunnel (O_1), would take a total of 46 buildings, causing the displacement and relocation of 89 families and 101 commerical enterprises. This alternative would also displace 23 commercial tenants from the piers.

The Outboard, with a single corridor interchange at the Holland Tunnel and the 35th Street corridor interchange at the Lincoln Tunnel (O_2), would displace 49 buildings, which would necessitate the relocation of 118 families and 86 commerical enterprises. This alternative would also displace 23 commercial tenants from the piers.

Particular Facilities Two large private facilities, along with commercial businesses operating from those piers which would be displaced by the Outboard alternative, have been intensively studied by Project staff.

The **Gansevoort-14th Street Meat Market** is the largest wholesale meat and poultry market in the New York metropolitan area. It houses approximately 120 firms which employ about 4,500 people. Most of the meat processed here is destined for Manhattan. Extensive capital improvements made in 1967 brought the market up to the latest code and sanitary conditions. Despite some pressure to move to the new Hunts Point Market in the Bronx, such changes have been resisted because of higher rents, the loss of money invested in recent capital improvements, the large distance from Manhattan, poor truck accessibility and lack of convenient public transit.

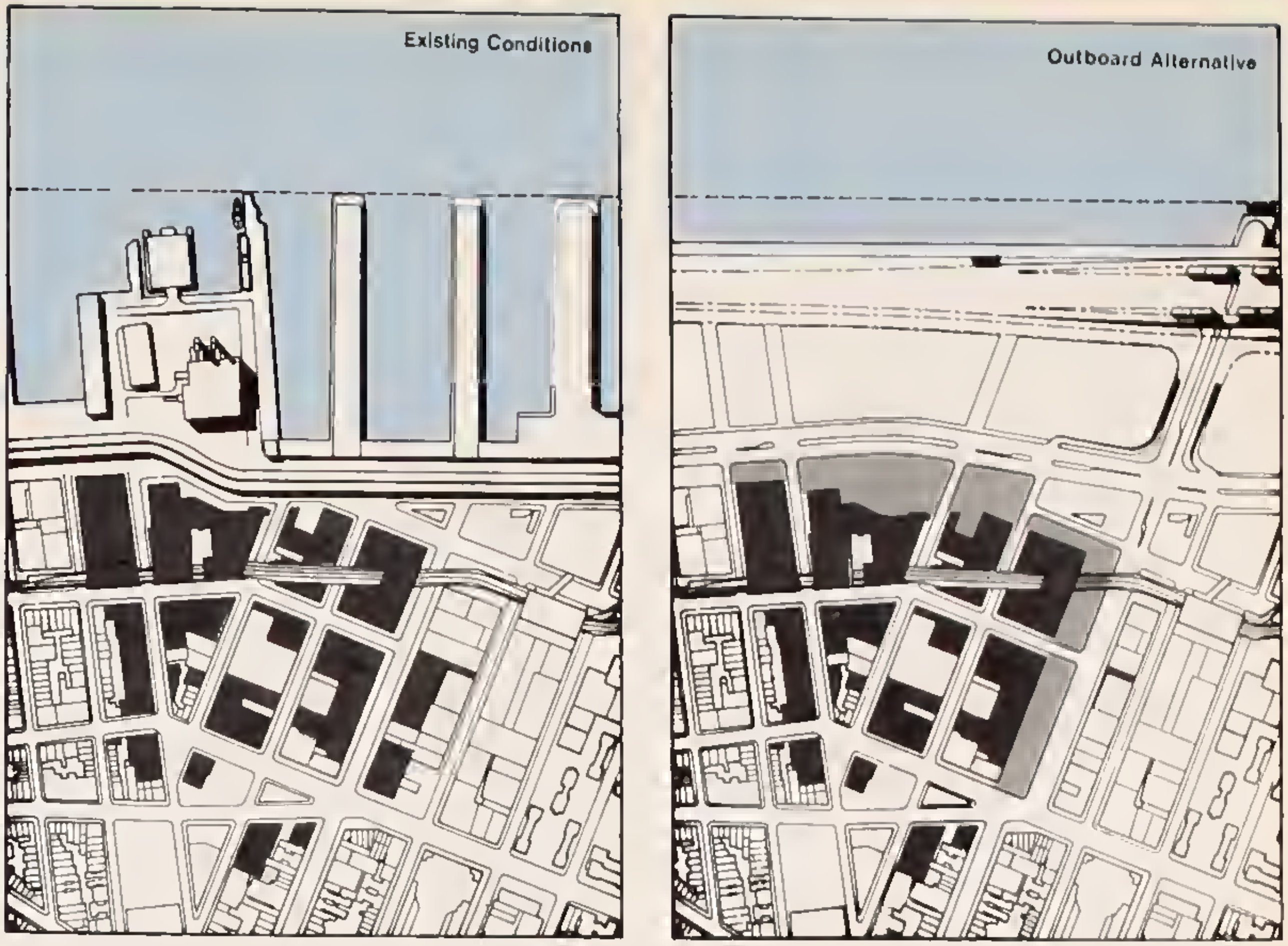


Illustration 116 The Gansevoort 14th Street Meat Market

■ Existing Meat Market Facility

▨ Area for Possible Expansion

North

Furthermore, 50 percent of the Gansevoort plants are owner-occupied. Small firms, in particular, could not afford the necessary capital investment in equipment and other start-up costs implicit in a move. Thirty firms rent from the City, which owns a block of property in the Market bounded by Little West 12th Street, Gansevoort Street, and Washington and West Streets. The market is discussed in detail in the Project **Preliminary Reports on the Gansevoort-14th Street Meat Market** (No. 5.05, December 1972).

The Outboard alternative would affect the Gansevoort Meat Market because connections between the new highway facility and the local street system would displace a small portion of the present market facilities along the north side of 14th Street, as shown in the accompanying illustration. The existing streets would have to be widened and upgraded between West Street and Ninth Avenue. The cleared strip would be reserved for exclusive use by market-oriented vehicles as a loading apron or parallel truck circulation. The new 14th Street would be separated from the parallel truck circulation and loading apron area by a 10-foot wide traffic barrier, allowing for uninhibited local truck flow between Ninth and Tenth Avenues.

The existing West Street would be reconstructed and left in its present alignment. Although space for truck circulation would be provided along the east side of West Street, no additional land would be available for new facilities. It is estimated that meat firms from the north side of 14th Street could be relocated to vacant space within the market area.

The **Colonial Sand and Stone Company** batching plant, locker room and parking facilities, presently located in the bulkhead area of Pier 72, would be displaced by the Outboard alternative. This site is important to the company because it provides convenient access to the many construction sites in Midtown and Lower Manhattan. The waterfront location also facilitates the delivery of raw materials by barges and scows which originate primarily in Kingston and Port Washington.

Travel time to a construction site is of utmost importance in this business because City regulations stipulate that on-site mixing of sand, aggregate, cement and water must occur within 30 minutes after leaving the batching plant. Concrete must then be unloaded 30 minutes after mixing. Hence, the maximum time allowed between the loading of raw materials and their discharge as concrete is one hour. Consequently, as part of the Outboard alternative, this Project could provide for relocaiton of the Colonial Sand and Stone Company along the waterfront in the vicinity of 38th Street, a few hundred feet from its present location, thus not affecting the critical element of travel time.

The **commercial businesses on Piers 26, 40, 46, 63, 66, and 77,** along the West Side waterfront would be eliminated by the Outboard alternative. All of these piers are currently used for commercial activities, which include some maritime commerce, privately-operated parking lots, moving and storage, parking and consolidating and freight forwarding. All of the firms presently operating on these piers would have to be relocated, but it is expected that there would be sufficient vacant space available to accommodate them, and that they would all be able to remain in business.

Inboard

The Inboard alternative, with a two-corridor interchange at the Holland Tunnel and a 30th Street corridor interchange for the Lincoln Tunnel (I_1), would impact 48 buildings (tenements, garages, lofts, warehouses), and would relocate 89 families and 91 commercial enterprises. In addition, there are 18 commercial tenants in the pier areas that would be relocated

The Inboard alignment, with a single-corridor interchange at the Holland Tunnel and a 35th Street interchange for the Lincoln Tunnel (I_2), would take 50 buildings (tenements, garages, lofts, warehouses), and displace 117 families and 66 commercial enterprises. It also would displace 21 commercial tenants from the piers.

The Inboard alternative also would displace the Colonial Sand and Stone Company, which could be relocated along the waterfront in the vicinity of 37th Street.

The commercial businesses on Piers 26, 46, 63 and 66 would be displaced by the Inboard alternative, which would require the relocation of a parking lot, two packing and consolidating companies, and a moving and storage firm. It is expected that these businesses could be successfully relocated.

Effects On Public Properties

Maintenance, Reconstruction and Arterial

These alternatives would have no effects on public properties in the West Side.

Outboard

The Outboard alternative would displace several public properties which are considered by the City to be very important. These are discussed in detail below.

Pier 40 This three-berth facility constructed in 1963, would be severely impacted by the Outboard proposal, and would require extensive reconstruction in order to be maintained as a maritime facility at its present location. This is treated in the Project **Report on Alternatives for Pier 40** (No. 5.12, May 1973). Port Authority officials and members of the New York Port Terminal Users Association have indicated that a functional relocation of Pier 40 passenger activity to Piers 94 and 95 in Midtown would be superior to any reconstruction at West Houston Street. The vehicle and passenger ramps being built to connect the three present Midtown piers of the new Consolidated Passenger Ship Terminal easily could be extended to include Piers 94 and 95, the next two piers to the north. The present berthing difficulties of a split terminal because of separate International Longshoremen's Association jurisdictions would be eliminated.

Two possible ways of functionally replacing Pier 40 activity are illustrated. The first alternative assumes that a two-berth facility at Pier 94 would cost $19 million in 1977 dollars, while a three-berth facility at Piers 94 and 95 would cost $35 million. The estimated cost of reconstructing Pier 40 in place is $45 million.

An in-place reconstruction of Pier 40 would likely cause some interference with shipping operations during construction, although it would be staged to minimize such interference. The Midtown replacement would not interfere with passenger operations because the new facilities would be built and put into use prior to demolition of the existing pier.

Piers 25, 32, 34, 42, 54, 57, 64, 70 and 76 Piers 25, 34, 54 and 64 are presently being used by the New York City Police Department as storage space for stolen or impounded vehicles. Pier 32 is used by the City for general storage space. Pier 57 is being used by the Metropolitan Transportation Authority (MTA) to store and repair buses. Many of the MTA's buses begin and end their daily journeys at Pier 57. Pier 70 is used as a heliport. Pier 76 is being used by the United State Postal Service to store vehicles. The New York State Department of Transportation has done an extensive survey of the real estate market in order to ascertain the availability of suitable replacement sites for these uses. Although the Project alternatives do not include provisions for specific replacement sites, the evidence indicates that there are sufficient sites available. Pier 42 is the mooring site of the Maritime Trades High School ship, *S.S. John Brown II*. This ship, which is owned by the New York City Board of Education, would be dislocated, but could be re-moored in the immediate area.

The Chelsea Piers Another major installation along the West Side waterfront which would be displaced by the Outboard alternative is composed of the Chelsea Piers—Piers 59, 60, 61 and 62. This four-pier shipping facility was remodeled to handle general cargo, but was closed down soon after the rebuilding program was completed in 1968. The adoption of containerization for the movement of general cargo by most lines on the trans-Atlantic runs caused the transfer of operations to other more suitable facilities. United States Lines, which had been leasing these piers from the Department of Marine and Aviation, recently reached an agreement with the City to terminate the lease for the Chelsea Piers and Pier 76, in exchange for moving their operations from New Jersey to Staten Island. Since these piers are vacant and no plans exist for their use, the Project would not relocate them.

The Gansevoort Destructor and Marine Transfer Station These facilities, which would be displaced by the Outboard alternative, comprise a solid waste disposal complex located on a seven-acre site between Piers 52 and 53 at West Gansevoort Street. The complex consists of an incinerator, barging facilities, salt shed and peripheral truck parking along the north side of Bloomfield Street, as described in detail in the Project **Preliminary Report on the Gansevoort Destructor and Marine Transfer Station** (No. 5.06, January 1973). The incinerator currently processes between 700 and 900 tons of refuse per day which after incineration is reduced to 400 tons and moved by truck to the Marine Transfer Station, and onto barges. The incinerator is relatively obsolete, is a source of air pollution, and is occasionally the center of local community controversy. According to the New York City Sanitation Department, it would cost between $6 and $10 million to upgrade the plant to meet current air pollution standards.

Sanitation Department officials have said that the Marine Transfer Station is indispensable to Manhattan, but that the incinerator is not, because of its small volume, frequent breakdowns and environmental detriments. The operation of the Marine Transfer Station could not be curtailed until a replacement facility were already in operation. But the incinerator could be discontinued while a replacement facility was being constructed, and its capacity absorbed by the Marine Transfer Station.

Replacement sites in conjunction with the Outboard alternative are provided for at Canal and/or 38th Streets. If built today, these sites would most likely contain shredders and a marine transfer station. However, by the time this alternative were constructed, the City Sanitation Department would like to be able to construct some type of facility incorporating "new technology" for solid waste disposal.

Marine Company 2 The fireboat of Marine Company 2, currently located at Pier 53, would be displaced by the Outboard alternative. The most important concerns of the New York City Fire Department are that any new facility must be located so as to provide reasonable service to the North River area, and that the present facilities must remain operational until any new facility is completed. If the fireboat were displaced, the West Side Highway Project would relocate it on the waterfront at 14th Street, and would provide direct vehicular access to the new facility.

Inboard

The Inboard alternative would have a much less severe impact on public properties than the Outboard. The Inboard was intentionally designed to leave structures such as the Chelsea Piers intact at their present location. With the exception of the incinerator portion of the Gansevoort Destructor and several piers, the public properties which would be displaced by the Outboard alternative would be left alone by the Inboard.

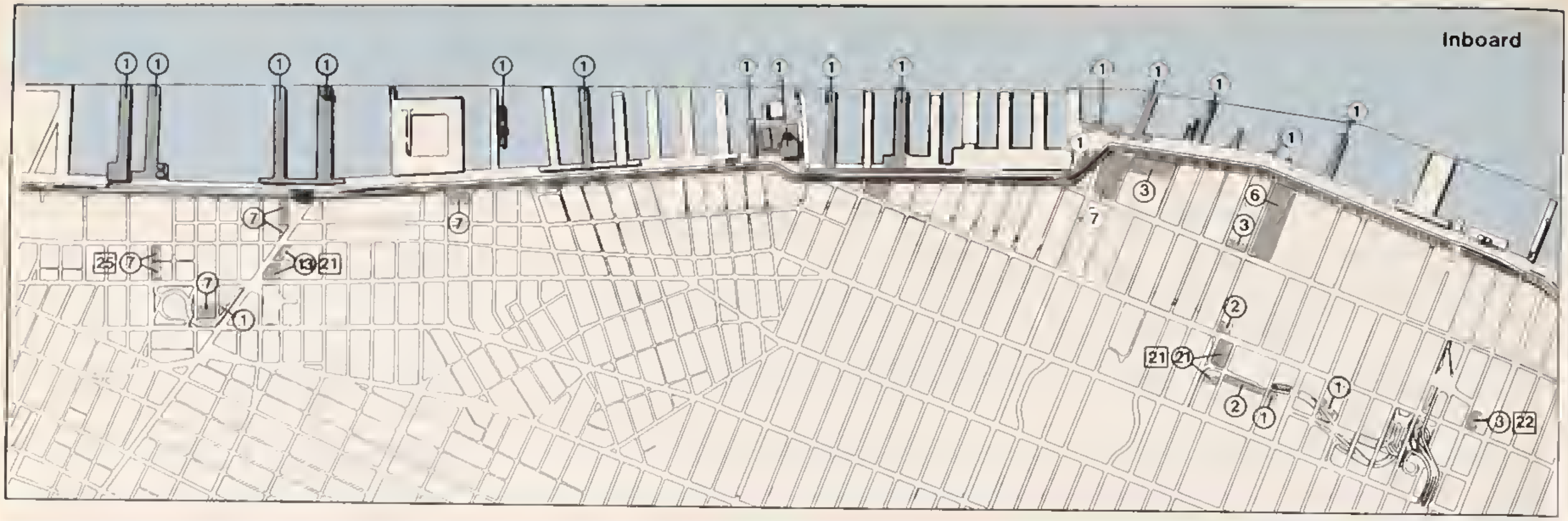
The piers impacted by the Inboard would include Piers 25, 34 and 40. There are adequate replacement sites available for the auto storage space on Piers 25 and 34. The impact to Pier 40 would be temporary, and the Pier would be kept in operation during construction. The West Side Highway Project has made no special provisions to relocate these pier activities at particular sites, though there are sufficient replacement sites available.

Relocation

Residential

A survey of the 1970 census records indicates a range of residential rents in the area which would be affected by the Holland Tunnel interchange of $45 to $76 per month for a three-room apartment. In the vicinity of the Lincoln Tunnel, the rentals for a three-room apartment had a range of $49 to $54, depending upon location. Since the census information is at least three years old, it is reasonable to assume that rents have increased about 15 percent since then, because of allowed increases for rent-controlled apartments and the de-control of vacant apartments. On that basis, the rental for a three-room apartment ranges from $52 to $92 per month with the average rental about $85 per month. Using this information as a base, the New York State Department of Transportation researched the New York real estate market. Initial concentration focused on the Project Corridor area extending from approximately two blocks east of West Street to the Hudson River, and from Brooklyn-Battery Tunnel to 50th Street, but was expanded to other areas of the City, since there is a scarcity of low-rent housing which satisfies current standards for decent, safe and sanitary housing.

Contact with real estate agents and newspaper advertisements indicated the availability in 1973 of rental apartments within a price range that could be afforded by people who might be displaced by a Project alternative. An upgrading in the quality of housing is necessary because most of the buildings that would be displaced are substandard, and families must be relocated in buildings which meet current standards. The higher rents would be offset by the State of New York's supplemental housing benefits program. In addition, the New York City Housing Authority, by letter dated February 27, 1973, has indicated a commitment to give to those families who desire it priority status for relocating to buildings under their jurisdiction. Relocatees would be required to meet Housing Authority eligibility requirements as to income and other standards for admission. Any residential relocations required should be accomplished within a minimum period of 18 to 24 months, and a maximum period of 30 to 36 months, depending upon which of the described alternatives is selected.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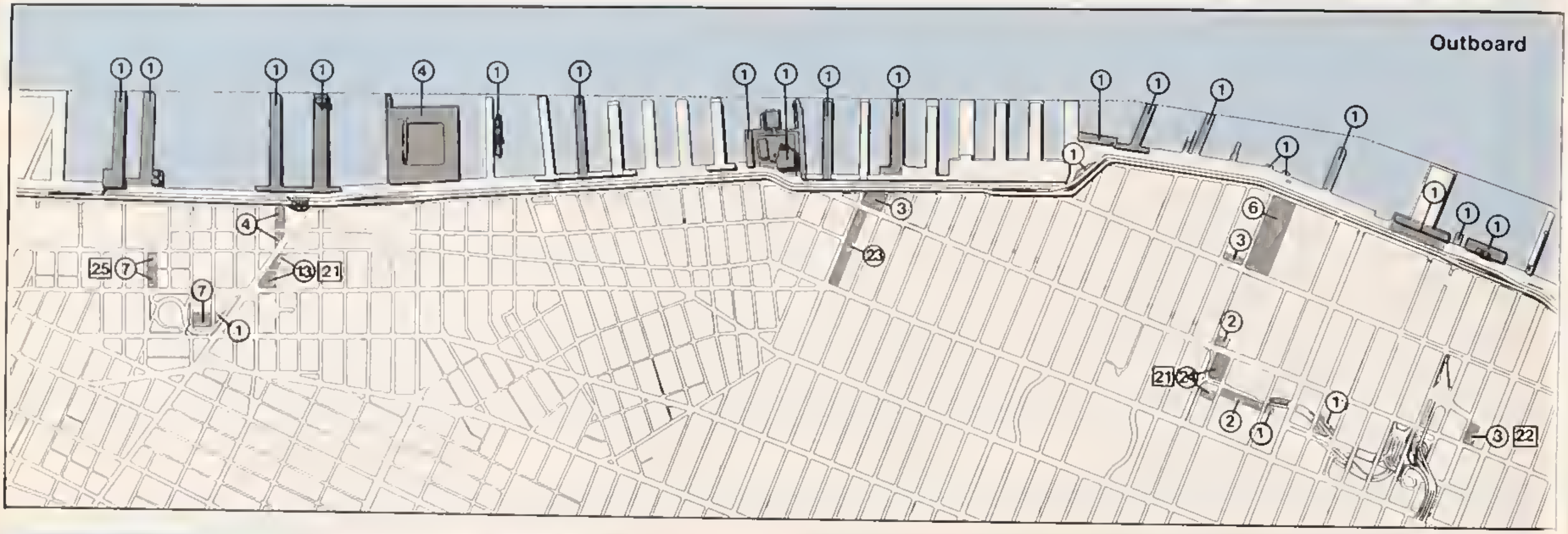
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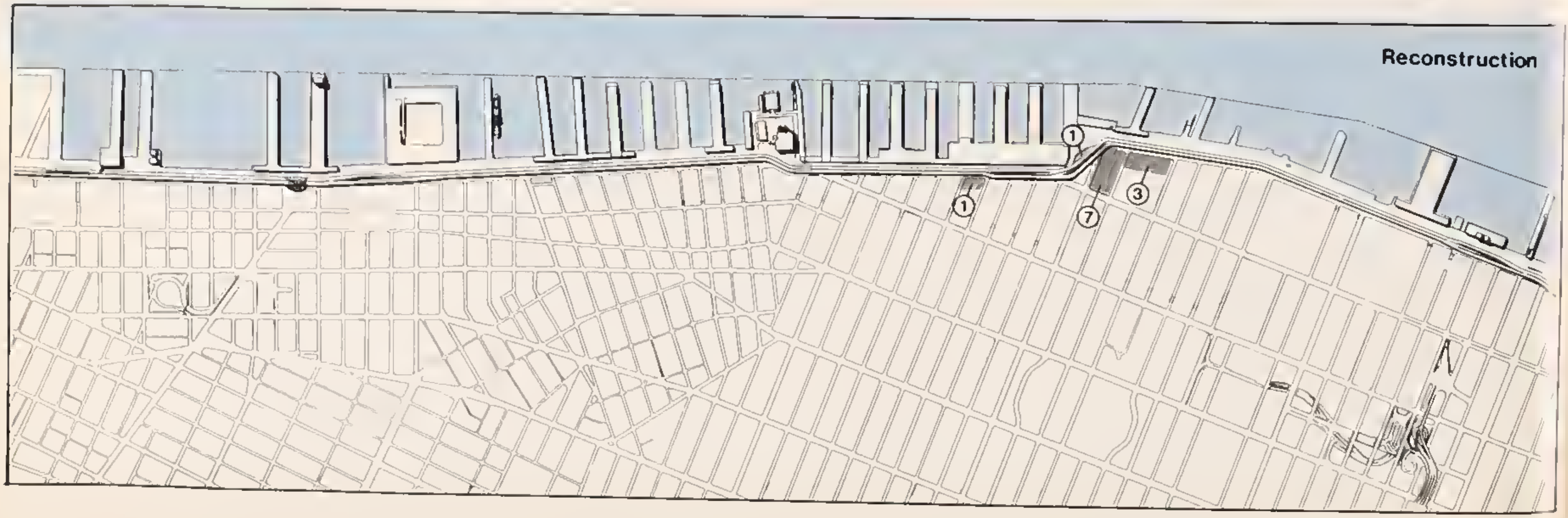
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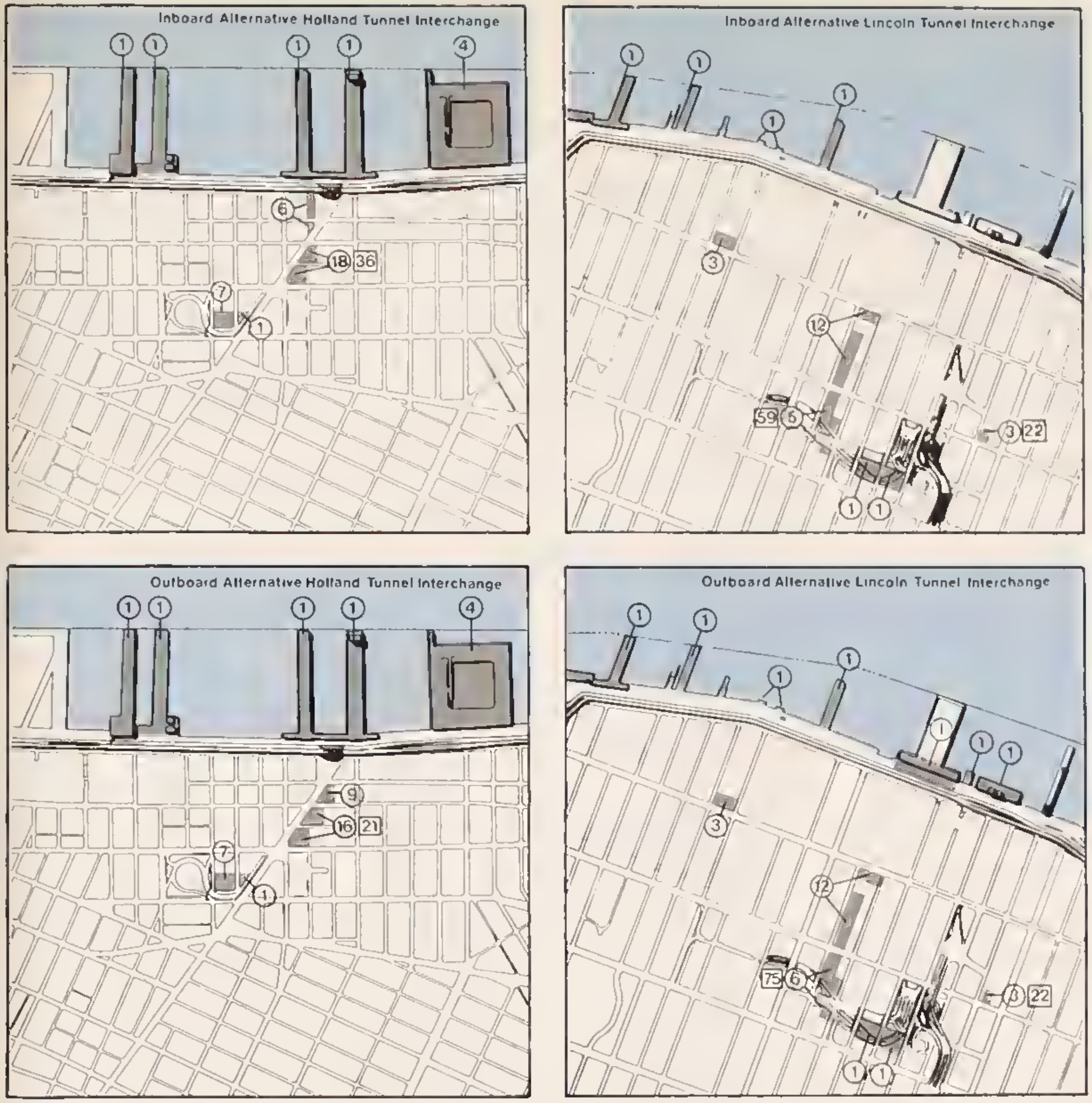
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Outboard Alternative Lincoln Tunnel Interchange
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Illustration 117 Business and Residential Displacement

–○ Business Displacement

22 Residential Displacement

North

Commercial

Most of the commercial buildings which would be displaced are very old, dating back to the turn of the century, and many have suffered significant physical deterioration. In many of the buildings at both major interchange areas for the Holland and Lincoln Tunnels, occupancy is limited to the street floor, even though the buildings may be multi-storied. New York State Department of Transportation surveys in the Project Corridor indicate sufficient available space to relocate most of these enterprises. The several neighborhood restaurants and bars, and some of the parking lots might have difficulty reestablishing and might therefore go out of business. The gas stations in the interchange area do not pump much gas, but depend on repairs and parking cars for local businessmen and truckers. These operations would be difficult to maintain, since there is not much vacant land in the area to permit the construction of gas stations. However, there are one-story structures which could be converted to repair shops so that the major part of these businesses would still remain.

Timing

After public hearings and the selection and approval of one of the Project alternatives, the Real Estate Division of the New York State Department of Transportation would prepare a detailed study of the relocations necessitated by the approved alternative, and would interview each tenant or property owner displaced. A "Relocation Plan" tailored to the needs of each individual affected would be prepared and forwarded to the State, and then to the Federal Highway Administration. After Federal approval of the Relocation Plan, the Real Estate Division would be able to proceed with the appraisal and acquisition of any affected properties.

Relocation Assistance and Services

The following assurances are made with respect to effecting whatever relocations would be required for implementation of a selected Project alternative. As part of the preparation procedure for the construction stage relocation plan, each site occupant would be personally interviewed to determine specific relocation needs. Relocation payments would be made to all eligible persons in accordance with the requirements and standards of Section 30 of the New York State Highway Law and the Federal Highway Administration Relocation Assistance regulations (Policy and Procedure Memoranda 81-1 through 81-1.4, November 22, 1972). The payment of moving expenses, supplemental relocation payments and other related payments would be available to occupants of any properties acquired, pursuant to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as implemented by the administrative regulations noted above.

Commercial Properties Affected by Reconstruction

Location of Displacement by Block	Numbers of Businesses	Types of Businesses	Estimated Number of Jobs
10th & 11th Aves., 17th & 18th Sts.	1	1 truck	6
11th & 12th Aves., 22nd & 23rd Sts.	1	U.S. Government Weighing Station	3
11th & 12th Aves., 23rd & 24th Sts.	7	1 truck rental 1 wholesale stationery 3 display advertisers 1 garage 1 trucking	54
11th & 12th Aves., 24th & 25th Sts.	3	3 freight forwarders	33
Total	12		96

Residential Properties Affected by Outboard

Outboard (O_1)

Location of Displacement by Block	Number of Residential Units	Estimated Number of Residents
Hudson & Greenwich Sts., Hubert & Beach Sts.	25	33
Hudson & Greenwich Sts., Spring & Canal Sts.	21	32
9th & 10th Aves., 30th & 31st Sts.	21	65
10th & 11th Aves., 41st & 42nd Sts.	22	35
Total	89	165

Outboard (O_2)

Hudson & Greenwich Sts., Spring & Canal Sts.	21	32
9th & 10th Aves., 35th & 36th Sts.	75	173
9th & 10th Aves., 41st & 42nd Sts.	22	35
Total	118	240

Commercial Properties Affected by Outboard

Outboard (O_1)

Location of Displacement by Block	Numbers of Businesses	Types of Businesses	Estimated Number of Jobs
Hudson & Greenwich Sts., Hubert & Beach Sts.	7	2 warehouses 1 iron works 1 garage 1 parking lot 1 luncheonette 1 union offices	34
Varick & Hudson Sts., Laight & Vestry Sts.	7	3 trucking 1 electrical supply 3 warehouses	42
Varick & Hudson Sts., Canal & Vestry Sts.,	1	Port Authority garage & training school	12
Hudson & Greenwich Sts., Spring & Canal Sts.	13	1 paint firm 1 warehouse 1 parking lot 5 trucking 1 luncheonette 1 messenger service 1 gas station 1 truck repair 1 bar & grill	92
Greenwich & West Sts., Watts & Canal Sts.	4	1 printing firm 1 shipping company 1 gas station 1 truck repair & rental	27
9th & 10th Aves., North side of W.14th St	23	13 meat companies 2 restaurants 1 garment factory 1 trucking 1 art firm 3 fabric firms 1 department store warehouse & computer center 1 parking lot (partial take)	200
10th & 11th Aves., 14th & 15th Sts.	3	1 gas station 1 diner 1 Army-Navy store	12
11th & 12th Aves., 22nd & 23rd Sts.	1	U.S. Government weighing station	3
11th & 12th Aves., 30th & 31st Sts.	6	5 trucking 1 railroad yard & storage	30
9th & 10th Aves., 30th & 31st Sts.	24	1 electrical contractor 1 weather-proofing contractor 1 metal cleaner 3 envelope manufacturers 1 uniform manufacturer 9 commercial launderers 4 metal novelty firms 1 trucking 1 binding manufacturer 1 jewel case manufacturer 1 parking lot	250
9th & 10th Aves., 31st & 33rd Sts.	2	2 parking lots	4
9th & 10th Aves., 33rd & 34th Sts.	1	1 parking lot (partial take)	2
9th & 10th Aves., 35th & 36th Sts.	1	1 parking lot (partial take)	2
10th & 11th Aves., 30th & 31st Sts.	2	2 trucking	24
11th & 12th Aves., 29th & 30th Sts.	3	1 trucking 1 diner 1 gas station	16
10th & 11th Aves., 41st & 42nd Sts	3	1 parking lot (partial take) 1 vending machine company 1 bar & grill 1 contractor	13
Total	101		763

commercial properties affected by outboard continued

commercial properties affected by outboard continued

Outboard (O_2)

Varick & Hudson Sts., Laight & Vestry Sts.	7	3 trucking 1 electrical supply 3 warehouses	42
Varick & Hudson Sts., Vestry & Canal Sts.	1	Port Authority garage & training school	12
Hudson & Greenwich Sts Canal & Spring Sts.	16	1 paint firm 2 warehouses 1 parking lot (partial take) 7 trucking 1 luncheonette 1 messenger service 1 gas station 1 truck repair 1 bar & grill	110
Greenwich & West Sts., Watts & Canal Sts.	9	2 gas stations 1 mechanical repairs 1 iron works 5 licensed electrical contractors	76
9th & 10th Aves., North side of W. 14th St.	23	13 meat companies 2 restaurants 1 garment factory 1 trucking 1 art firm 3 fabric firms 1 department store warehouse & computer center 1 parking lot (partial take)	200
11th & 12th Aves., 14th & 15th Sts.	3	1 gas station 1 diner 1 Army-Navy Store	12
11th & 12th Aves., 22nd & 23rd Sts.	1	U.S. Government weighing station	3
11th & 12th Aves., 29th & 30th Sts.	3	1 trucking 1 diner 1 gas station	16
10th & 11th Aves., 35th & 36th Sts.	12	12 trucking	72
9th & 10th Aves., 35th & 36th Sts.	6	1 restaurant 3 trucking firms 2 parking lots	28
9th & 10th Aves., 37th & 38th Sts.	1	1 partial take of parking lot of bus company	[illegible]
9th & 10th Aves., 38th & 39th Sts.	1	1 partial take of parking lot of bus company	[illegible]
10th & 11th Aves., 41st & 42nd Sts	3	1 parking lot (partial take) 1 vending machine company 1 bar & grill 1 contractor	13
Total	86		584

Residential Properties Affected by Inboard

Inboard (I_1)

Location of Displacement by Block	Number of Residential Units	Estimated Number of Residents
Hudson & Greenwich Sts., Hubert & Beach Sts.	25	33
Hudson & Greenwich Sts., Spring & Canal Sts.	21	32
9th & 10th Aves., 30th & 31st Sts.	21	65
10th & 11th Aves., 41st & 42nd Sts.	22	35
Total	89	165

Inboard (I_2)

Hudson & Greenwich Sts., Spring & Canal Sts.	36	54
9th & 10th Aves., 35th & 36th Sts.	59	136
10th & 11th Aves., 41st & 42nd Sts.	22	35
Total	117	225

Commercial Properties Affected by Inboard

Inboard (I_1)

Location of Displacement by Block	Numbers of Businesses	Types of Businesses	Estimated Number of Jobs
Hudson & Greenwich Sts., Hubert & Beach Sts.	7	2 warehouses 1 iron works 1 garage 1 parking lot 1 luncheonette 1 union offices	34
Varick & Hudson Sts., Laight & Vestry Sts.	7	3 trucking 1 electrical supply 3 warehouses	42
Varick & Hudson Sts., Canal & Vestry Sts.	1	Port Authority garage and training school	12
Hudson & Greenwich Sts., Canal & Spring Sts.	13	1 paint firm 1 warehouse 1 parking lot 5 trucking 1 luncheonette 1 messenger service 1 gas station 1 truck repair 1 bar & grill	92
Greenwich & West Sts., Watts & Canal Sts.	7	1 printing firm 2 shipping 1 gas station 2 warehouses 1 truck repair & rental	45
Washington & West Sts., Clarkson & Leroy Sts.	7	1 bar & grill 1 restaurant 1 messenger service 1 garage 2 trucking 1 machinists & engineers	44
11th & 12th Aves., 22nd & 23rd Sts.	1	U.S. Government weighing station	3
11th & 12th Aves., 23rd & 24th Sts.	7	1 truck rental 1 wholesale stationer 3 display advertisers 1 garage 1 trucking	54
11th & 12th Aves., 24th & 25th Sts.	3	3 freight forwarders railroad tracks	33
11th & 12th Aves., 29th & 30th Sts.	3	1 trucking 1 diner 1 gas station	16
11th & 12th Aves., 30th & 31st Sts.	6	5 trucking 1 railroad yard & storage	30
9th & 10th Aves., 30th & 31st Sts.	21	1 electrical contractor 1 weather-proofing contractor 1 metal cleaner 3 envelope manufacturers 1 uniform manufacturer 9 commercial laundries 4 novelty firms 1 trucking	236
10th & 11th Aves., 30th & 31st Sts.	2	2 trucking	24
9th & 10th Aves., 31st & 33rd Sts.	2	2 parking lots (partial takes)	4
9th & 10th Aves., 35th & 36th Sts.	1	1 parking lot (partial take)	2
10th & 11th Aves., 41st & 42nd Sts.	3	1 bar & grill 1 vending machine company 1 contractor 1 parking lot (partial take)	13
Total	91		684

Inboard (I_2)

Varick & Hudson Sts., Laight & Vestry Sts.	7	3 trucking 1 electrical supply 3 warehousing	42
Varick & Hudson Sts., Canal & Vestry Sts.	1	Port Authority garage & training school	12
Hudson & Greenwich Sts., Spring & Canal Sts.	18	1 paint firm 2 warehouses 9 trucking 1 luncheonette 1 bar & grill 1 messenger service 1 gas station 1 truck repair 1 parking lot	113
Greenwich & West Sts., Watts & Canal Sts.	6	1 printing firm 1 shipping company 2 gas stations 1 truck repair 1 truck rental	35
11th & 12th Aves., 22nd & 23rd Sts.	1	U.S. Government weighing station	3
11th & 12th Aves., 23rd & 24th Sts.	7	1 truck rental agency 1 wholesale stationer 3 display advertisers 1 garage 1 trucking	54
11th & 12th Aves., 24th & 25th Sts.	3	3 freight forwarders some railroad tracks	33
11th & 12th Aves., 29th & 30th Sts	3	1 trucking 1 diner 1 gas station	16
10th & 11th Aves., 35th & 36th Sts.	12	12 trucking	72
9th & 10th Aves., 35th & 36th Sts.	6	1 restaurant 2 trucking 2 parking lots	20
9th & 10th Aves., 37th & 38th Sts	1	1 parking lot (partial take)	0
9th & 10th Aves., 38th & 39th Sts.	1	1 parking lot (partial take)	0
10th & 11th Aves., 41st & 42nd Sts.	3	1 bar & grill 1 vending machine company 1 contractor 1 parking lot (partial take)	13
Total	68		413

Impacts During Construction

Construction by its very nature is disruptive to established physical facilities and patterns of activity. The impacts, essentially all adverse to the environment, are temporary and depend to a great extent on the kind of construction, how it is carried out and the controls which are exercised to minimize the disruptive influences.

The Steering Committee recognized these potential problems and included four policy statements which gave guidelines to the planning activities in developing the alternatives.

■ **Determine the best means to maintain and/or enhance the existing social, economic and physical characteristics of the local area goals and objectives, both during and after construction.**

■ **Stage reconstruction of the facility to minimize travel disruption in surrounding communities during construction.**

■ **Provide maximum practicable pollution controls during the construction phase of the Project.**

■ **Assure that the Project design reflects compliance with appropriate Federal, state and local air, noise and water environmental standards and additionally that such standards are adhered to during construction.**

Principal planning for construction of each of the alternatives occurred while the existing Highway was still in operation. Thus, the various construction plans include provisions for maintaining traffic on the present Highway until work is completed on a particular alternative. The construction impacts evaluated and described initially in this discussion include those which contemplate an open and operating West Side Highway during building of one of the alternatives. Also discussed is the possibility that the existing Highway will not be in operation upon the selection and implementation of one of the alternatives. If the existing facility remains closed, then plans for maintaining West Side traffic would be different, requiring that vehicles be detoured along parallel streets and on West Street beneath the present elevated structure. This condition would modify the timing, cost and environmental effects of constructing each alternative.

Effects on Traffic

In order to develop traffic maintenance plans, it was necessary to develop a construction procedure and schedules for each alternative. The objective of these studies was to maintain a minimum of four through traffic lanes for West Side Highway traffic and two lanes in each direction for West Street and Twelfth Avenue traffic. The detailed engineering plans, along with schedules for construction and traffic maintenance are presented in the **Design Report**.

Construction scheduling for the Project alternatives was planned so that traffic on the existing viaduct would be maintained as long as practical. For the alternatives which would include a new interstate highway, segments of the new highway would be located west of the existing viaduct during the early years of construction. As portions of the new highway were completed, the traffic would be transferred to them. The existing viaduct would then be demolished, and the new highway and West Street completed. Ramp access from the local streets to the Highway would be maintained at all times by using existing, temporary, or new roadways, and access to all properties fronting the construction area would be continuously maintained.

The construction methods discussed for all alternatives were developed in enough detail to reasonably predict construction impacts. Other methods of construction and scheduling may be developed during final design and construction which would lessen the adverse impacts. In no event would construction impacts be greater than described below. This can be assured through contract specifications.

Maintenance

The short-term view of traffic disruption during construction for the Maintenance alternative must consider the fact that the first priority would be to repair the 60-foot collapsed section of the elevated Highway at Gansevoort Street, and to repair other sections of the structure which were determined to be unsafe and unusable. These repairs south of 46th Street would disrupt only West Street traffic, since the Highway itself is presently closed to traffic.

An example of the kinds of impacts of such an alternative were demonstrated during the reconstruction of 1,000 feet of roadway deck in the three southbound lanes between West 15th Street and Little West 12th Street, performed in the fall and winter of 1973. These repairs required the following detours: two of the three southbound lanes were detoured off the Highway at the 48th Street exit and diverted to Twelfth Avenue, Eleventh Avenue and West Street, except during afternoon hours; the remaining southbound lane exited at 18th Street, except during the morning rush hours; southbound entrance ramps at 54th Street, 40th Street, and 19th Street were closed; northbound traffic on Twelfth Avenue intending to enter the Highway at 46th Street was detoured to the 57th Street entrance, except during the afternoon hours. This special repair project was scheduled for a three-month contract period. The City expects that similar repair projects would be a regular occurrence by the early 1980's, and would be frequent thereafter. Such recurring repair projects would produce a series of detours for at least part of, or perhaps the full length between the Battery and Midtown. Regular interruption of West Side Highway traffic and its required detouring onto local streets could be anticipated to occur for many years. Depending upon the extent of the maintenance work, the detoured traffic would increase congestion by varying degrees on local streets.

Over the long term, even after initial repairs are made, the condition of the entire existing Highway is such that continuous work would be required to maintain the roadway deck and supporting structure for the remaining life of the facility. Construction and repair activity would be confined to the immediate vicinity of the viaduct for short periods of time.

Reconstruction

The Reconstruction alternative would make major structural changes on the existing viaduct between the Battery and 72nd Street Work performed within the limits of the Study Corridor would take about nine years. This construction time would depend on the results of an extensive field inspection to determine the exact condition of the viaduct. If there is extensive deterioration, the time and cost of reconstruction could be considerably increased.

As with the Maintenance alternative, construction activity would be confined to the immediate vicinity of the viaduct. There are three types of construction required south of 42nd Street. The first is in areas of completely new structure. In such areas, West Side Highway traffic would be maintained on either the existing viaduct or temporary bridges, or both, as the new construction progresses. The second location is where the existing viaduct is to be rehabilitated and widened, and there would not be enough room to maintain two lanes of traffic in each direction on the existing viaduct. In these cases, temporary bridges would be constructed adjacent to the existing viaduct.

The third type of construction would be located in areas where the viaduct would be widened, and where there would be enough room to maintain traffic on the existing viaduct during the widening. Essentially, a temporary deck would be placed over the median to allow two lanes of traffic in one direction near the center of the viaduct, and to allow two lanes of traffic in the other direction on the other side of the viaduct. The side opposite where traffic is maintained would be widened, and the traffic shifted so that two lanes would be using two lanes of the new portions and two lanes using the temporary deck in the center. The opposite side of the viaduct would then be widened. When completed, the traffic on the temporary deck in the center would be shifted to the completed portion. The center section of the viaduct would then be completed. Four lanes of local West Street-Twelfth Avenue traffic would be maintained adjacent to or under the temporary bridges and existing viaduct.

North of 42nd Street, the viaduct would have to be removed prior to rebuilding, and West Side Highway traffic would have to be detoured to local streets at 72nd Street. Detours leading into Eleventh Avenue would exist approximately four years, and would increase traffic and time delays on this thoroughfare between 23rd and 72nd Streets. Work north of 42nd Street would take about five years, raising the total time of reconstruction to about 12 years.

Construction equipment on the West Street detours would occupy some of the space now used for parking under and alongside the viaduct, and traffic on West Street would have to be detoured around this equipment. Two traffic lanes would be maintained in each direction for local traffic and access to abutting properties at all times during construction. However, it can be anticipated that the construction process would cause interference and delays to local traffic.

In order to minimize traffic disruption, reconstruction would start at the south and proceed north. The first contract would last about five years and would extend to the Canal Street bridge. In this area, traffic is light and there would be sufficient width to maintain traffic, with little local disruption. The traffic impact on this area during the first phase of construction would be as follows.

- From Rector Street to Duane Street, interference to local West Street and Marginal Street traffic would be minimal because the roadway construction would consist only of providing a new concrete roadway slab, safety parapet, and median barrier for the existing structure between Liberty and Duane Streets.

- From Duane Street to Hubert Street, the existing structure would be widened on both sides, with a new southbound off ramp constructed. The existing ramps would be combined to service only northbound (on) traffic. Construction would be staged so that except for short intervals, ramp access could be maintained at Duane Street, and two lanes of local traffic would be continuously maintained adjacent to the viaduct construction.

- Between Hubert Street and the Canal Street bridge, it would be necessary to construct a temporary two-lane viaduct on each side of the new construction in order to keep Highway and West Street traffic separated. Traffic would have to be detoured to temporary roadways under the existing viaduct during construction of the temporary viaducts. Two lanes of local traffic would be maintained in each direction, and after completion of the temporary viaducts, local traffic would travel under them. During the construction of West Street, local traffic would run under the new viaduct.

During this entire process, access to adjacent buildings on West Street would be preserved by maintaining a portion of the existing pavement apart from the width required for detour roads. The only disruption to communities north of Canal Street during this first contract phase would be trucks delivering construction materials or removing debris. If construction materials and debris could be delivered and removed by water, then the traffic impacts north of Canal Street would be further mitigated. The possibility of utilizing water transportation for some tasks is good, since many West Side piers are and will continue to be vacant.

The second phase of construction, starting three years after the first, would cover the area from Canal Street to 23rd Street, and would have little effect on local traffic outside that area. The construction traffic in these areas would be similar to that explained above.

- During construction of a new viaduct and access ramps between Canal and Houston Streets, a temporary two-lane viaduct would be necessary on the western side of the new construction. Northbound local traffic would be detoured to Washington Street via Spring Street and West Houston Street for a period of approximately two years. Short intermittent delays in the trucking operations on Washington Street and delays for northbound local traffic can be anticipated.

- From West Houston Street to Morton Street, access would be maintained to West Street properties, together with two lanes of local West Street traffic in each direction.

- From Morton Street to Horatio Street, work would be confined to the superstructure of the existing viaduct, enabling the Project to maintain four lanes of Highway traffic on the viaduct by the procedures previously described and two lanes of local traffic in each direction at all times

- From Horatio Street to 13th Street, two temporary two-lane viaducts would be constructed for West Side Highway traffic, with two lanes of local traffic under each of them. Upon completion of the new viaduct, local traffic would be under it, until the service roads were completed. From 13th to 23rd Streets, no major disruptions of Highway or local traffic are anticipated, though northbound local traffic would have to travel under the existing viaduct during construction of a northbound off ramp at 18th Street. Access for emergency and service vehicles would be maintained at all times.

Construction of the third phase would extend from 23rd to 42nd Streets, for about five years. The traffic impact would be minimal on the communities south of 23rd Street, but new ramp construction at 23rd Street would require the use of temporary bridges, to maintain Highway traffic on viaduct. Also, the existing ramp connections near 23rd Street would be out of service for approximately two years During construction of a new local roadway system between 23rd and 42nd Streets, traffic would be maintained on the existing streets.

If the Reconstruction alternative were extended to 72nd Street, the most efficient procedure would be to detour traffic from the West Side Highway to local streets at 72nd Street, demolish the existing facility and build a new viaduct in approximately the same location. This work would take approximately five years, and during most of this time traffic would use the local avenues. Local streets would be used to connect traffic back to the reconstructed highway. Eleventh Avenue would be the primary detour route for traffic during the peak hours, causing traffic delays and jams and adversely affecting residents and businesses along the detour route.

Arterial

Assuming construction of the Arterial alternative with a transitway, construction from the Battery to 42nd Street could be accomplished in approximately nine years, and the segment from 42nd to 72nd Streets would take about four years. During construction, a minimum of four through lanes of West Side Highway traffic south of 42nd Street would be maintained at all times, as would the existing connections to the Brooklyn-Battery Tunnel and the World Trade Center underground parking facility. Local traffic would use the existing right-of-way, except when detoured to demolish the existing viaduct and construct the Arterial roadway and transitway.

In general, the Arterial construction would advance ahead of the demolition work, so that when a section of the viaduct would be closed to traffic, adequate approach roadways to the south would be available to accommodate the viaduct traffic. Access to private properties along both sides would be maintained most of the time. In some areas, access to the piers might be cut off for short periods of time during the initial phases of transitway construction where the cut would be temporarily decked. This loss of access could be minimized by staging the initial phases of the transitway construction to off-peak hours.

Inconvenience and delays would occur during the demolition of the existing viaduct and also during construction of the transitway, when existing roadways would be restricted by the presence of construction equipment. It is possible that some traffic from the West Side Highway would be diverted to local streets and avenues as a result. Where possible, additional temporary roadways within the West Street-Twelfth Avenue right-of-way would be constructed to alleviate this problem. If the transitway follows the Eleventh Avenue alignment, there would be a disruption to West Street traffic where the transitway leaves West Street to enter Eleventh Avenue. There would be similar disruption to Eleventh Avenue traffic in the area where the transitway would be located. This disruption could be minimized by staging construction of the transitway in these areas to off-peak hours. The temporary decking would allow the traffic to use Eleventh Avenue for most of the time. However, on any street or avenue where major construction would take place, there would be delays to the traffic to some degree. The effect on traffic once the transitway leaves Eleventh Avenue and enters the railroad yards would be minimal.

During construction between 42nd and 72nd Streets, local roadways would be congested, and detours to parallel north-south avenues would be necessary during demolition of the existing viaduct. The impact in this area would be similar to that discussed for the Reconstruction alternative if the transitway is in the Eleventh Avenue alignment.

However, with the transitway alignment in Twelfth Avenue, there would be disruption of the Twelfth Avenue traffic. The width of that street is such that the cut and cover operation for the transitway would cause delays in traffic on Twelfth Avenue. Staging of construction would reduce the level of disruption, but would not eliminate it. The transitway construction in Twelfth Avenue would probably cause some of the traffic using Twelfth Avenue to divert to local streets.

Inboard

Construction for the Inboard, which includes a new six-lane interstate facility and a transitway for bus or rail service, would be scheduled over a ten-year period. In general, the sequence of construction would start at the south end of the West Side waterfront and proceed northward. Such staged construction would allow maximum use of the existing West Side Highway, and would confine traffic impacts to specific areas for short periods of time.

The first major contract would cover the area from Battery Place to Harrison Street. During the first two years of construction, traffic at the Brooklyn-Battery Tunnel would be delayed for short periods by the relocation of utilities and removal of portions of the existing underpass. Construction would be done in off-peak traffic hours during the remaining seven years, when the only major construction impact in this area would occur on the approach roads to the Brooklyn-Battery Tunnel. These approach roads, which presently have seven lanes of traffic, one of which is reversible, would be reduced to at least two inbound and two outbound lanes, plus one reversible lane. The approach lanes from West Street would be restricted during this construction, and the storage of traffic during the peak rush hours would be impeded.

Movement of traffic at the Battery Park Underpass approaches would be disrupted for short periods of time by relocation of utilities. Other disruptions would occur during construction of a Battery Place overpass, the southbound ramp from the mainline to the Battery Park Underpass and local surface paving operations. However, at least one lane would be maintained in each direction during off-peak hours, and two lanes in each direction would be operational during peak periods. Traffic seeking alternate routes to and from Lower Manhattan would probably use the FDR Drive, or Broadway and Trinity Place-Church Street. However, these routes are presently used to capacity during peak periods, though they do have excess off-peak capacity.

Construction of the Inboard depressed alignment would require extensive detouring of West Street traffic to adjacent northbound and southbound streets such as Washington and Greenwich Streets. During construction year six, northbound traffic from West Street would be detoured to Washington Street via Hubert Street, then to Greenwich Street via Spring Street. This detour would be in effect for from two to three years.

Southbound traffic from Marginal and West Streets would be detoured to Washington Street via Little West 12th Street, and to West Street via Spring Street during construction years six through nine. In order to maintain detour traffic, it would be necessary to limit trucking operations to off-peak hours, and to strictly enforce no parking controls along the detour routes.

During construction years three through ten, traffic flow at the intersection of Canal and West Streets, and in West Street in front of Pier 40, would be hindered by construction operations. Up to year six, it would be necessary to provide access to off and on ramps for the existing West Side Highway viaduct, and also to provide temporary bridges over the new construction to allow service to Pier 40 and southbound West Street. From year six to nine, the existing traffic on the West Side Highway viaduct would be detoured to the completed southbound mainline, which is wide enough to allow two lanes of traffic in each direction as a temporary measure. During years six through nine, Pier 40 and business establishments, primarily truck freight terminals, would be serviced only by northbound traffic on West Street, because southbound West Street traffic would be detoured to local streets.

Traffic moving from 15th Street to 23rd Street along Eleventh Avenue would be affected by a temporary viaduct which would be constructed to carry West Side Highway traffic. This traffic would require rearrangement of access and storage areas on the Chelsea Piers, but access would eventually be improved by the new frontage roads. The demolition and construction of the new highway and transitway would modify the circulation patterns on 16th, 17th, 18th, 19th, 20th, 21st and 22nd Streets, between Tenth and Eleventh Avenues. One-way patterns would be temporarily reversed to aid traffic flow, but traffic operations would not be significantly impaired. Ultimately, circulation would be improved by the new southbound and northbound frontage roads.

The construction of temporary viaducts, demolition of the existing Highway viaduct, and new construction at 42nd-44th Streets would impose some temporary inconvenience and time delays on the large volume of traffic which uses this area for access to the Highway and for general circulation.

During construction of an Eleventh Avenue transitway, temporary decking would be required on Eleventh Avenue, causing minor disruptions during decking installation and removal, though this would be accomplished during off-peak hours. Railroad operations would be coordinated with the transitway installation. In the area from 39th to 42nd Streets, Lincoln Tunnel approach operations, particularly an existing ramp to the Port Authority Bus Terminal, would require extensive modifications for the construction of the transitway. Major traffic diversions, with resulting travel delays, would be required during the construction of the new approaches. Travel on the bypass roadways between 30th Street and the tunnels would be heavily curtailed for long periods of time. However, traffic to and from the tunnels would be maintained at all times.

Surface traffic would also be affected by the closing of the following cross streets between Ninth and Tenth Avenues or Dyer Avenue at staggered intervals: 33rd, 35th, 36th, 37th and 39th Streets. As these cross streets were closed in order to construct bridges over the approach roadways to the Lincoln Tunnel, adjacent east-west streets would be required to carry the through traffic loads of the closed streets. In ordar to handle these traffic increases, it would be necessary to strictly enforce no parking regulations, and possibly to change traffic signalization practices to favor these detour routes.

Outboard

The Outboard alternative consists of a new six-lane interstate highway and transitway. From its connection to the Brooklyn-Battery Tunnel and the Battery Park Underpass to Harrison Street, the traffic effects would be similar to those described for the Inboard alternative.

From Harrison Street to 23rd Street, where both the transitway and highway would be located in new landfill between the bulkhead and pierhead lines, the effect on local traffic would be minimal except for the period when the existing Highway is torn down. During this time, the traffic effects would be similar to those discussed for the Arterial alternative.

From 23rd to 42nd Streets, transitway construction in Eleventh or Twelfth Avenues would cause some disruptions to local traffic. The effect on traffic for the Eleventh Avenue transitway route would be exactly the same as was described for the Inboard alternative. The effect on traffic for the Twelfth Avenue transitway route would be limited to the area between 37th and 44th Streets, where the transitway is in the existing right-of-way of Twelfth Avenue. In this area, the impact of construction would be severe to the Circle Line and Consolidated Passenger Ship Terminal facilities, due to the additional transitway construction and street level cross road overpasses required. The effects of the interchanges for the Outboard would be similar to those described for the Inboard alternative.

Outboard construction would be staged over a ten-year period. As with the Inboard, the first two to three years would be occupied by the construction of protective structures for the Hudson River tunnel crossings, demolition of piers and headhouses and the creation of new landfill. Construction of the entire mainline structure and transitway would be staged over the first seven years, beginning with the southern section where landfill already exists. While this construction is underway, traffic would be maintained on the existing roadways north of Harrison Street. Since this alternative would eliminate all present Hudson River pier activities between the Battery and Midtown, West Street and Twelfth Avenue traffic movements south of 37th Street would be lighter than they are now. Use of the Hudson River to transfer materials for the landfill operations would alleviate traffic impacts on West Street and Twelfth Avenue.

In construction years eight through ten, the existing West Side Highway viaduct would be demolished, the interchanges completed, and the remaining portions of the service roads built. These activities would cause minor disruptions to traffic, since highway traffic would be operating on the newly constructed Outboard mainline facility.

Effects on Noise Levels

The construction equipment used for any of the alternatives would contribute to an increase in the general noise level in nearby communities. Since each alternative would require partial or total demolition of the existing Highway and other structures, air compressors, jackhammers, paving breakers, welding machines, cranes and large trucks would be used. The placement of concrete would require the use of trucks, cranes, vibrators, and power saws. Pile driving would be required for each alternative except Maintenance, whether it be sheet piling for excavation or pile supports for new structures. Earth-moving operations would utilize bulldozers, dredges, cranes and trucks. The impact of these noises on adjacent communites would depend upon the magnitude of the sound level permitted at the source, the distance to the affected area, and the duration of the noise-producing activity.

The City of New York has recently adopted one of the most rigid and comprehensive noise control codes in the United States (Local Law No. 57, September 1, 1972) and all firms performing work on this project would be contractually required to adhere to this code. For residential areas, these requirements limit the noise to 75 dBA between 7:00 A.M. and 6:00 P.M. on weekdays and 60 dBA at all other times, including day and night on weekends. A limit of 85 dBA is set for commercial business locations. The noise would be measured at the street-line of the building nearest to the job site.

The mechanism for enforcement of the specified noise levels during construction would usually consist of monitoring and directing the contractor. Monitoring would be done with sound level meters operated by a trained engineer assigned to the project. If the monitoring were to disclose that the specified levels were being exceeded, the contractor could be ordered to stop work.

The methods by which the contractors would be expected to comply with the noise abatement requirements include the addition of intake and exhaust mufflers to internal-combustion equipment; sound-attenuating housings for machinery; replacement where possible of internal-combustion by electric motive power; and, the utilization of commercially-redesigned equipment, such as the quieted air compressors and pavement breakers now on the market, as it becomes available due to industry response to the Federal Occupational Safety and Health Act, which limits a worker's exposure to noise. The New York City Transit Authority has shown that compliance with the New York City Noise Control Code can produce dramatic reduction in construction noise levels.

Another positive measure that could greatly reduce construction noise from the diesel engines of material hauling trucks is the requirement that water transport of construction materials be used to the maximum possible extent. For each alternative, adequate marine transfer facilities could be maintained so that the city streets leading to the Project area could remain free of construction traffic to the maximum extent.

These requirements could be included in the construction contract documents for the selected alternative. However, the relative noise level perceived by the adjacent communities would vary, depending on the alternative chosen. Increases in local area noise levels due to traffic diverted from the existing Highway and West Street-Twelfth Avenue would be affected most by truck diversions. The following is a qualitative comparison of the noise expected to result from construction of the various alternatives.

Maintenance

The construction noise impacts of the Maintenance alternative, as it was originally conceived, would be relatively minor. For the kind of maintenance anticipated, construction noise would be generated only from the immediate vicinity of the existing Highway, for relatively short distances, and for a few months at a time. No pile driving is anticipated for these operations. The noise impact of a major maintenance or large-scale rehabilitation of the Highway would be greater. Closing of the Highway and diversion of its traffic onto parallel routes and local streets would have limited noise impact, since the vehicles diverted would be autos which operate relatively quietly at slow speeds.

If a decision is made to tear down the existing structure, the noise impacts would be greater, and would resemble those described for the Arterial alternative.

Reconstruction

The Reconstruction alternative would include some land clearing and demolition operations, utilizing heavy construction equipment. Construction work would be phased over a five-year period. Some pile driving would be required, but steps such as those necessary to comply with the City Noise Code would minimize the noise produced by this work.

Arterial

During the construction phase for the Arterial alternative, there would be a significant increase in the noise levels within the Project area. The major reason is the proximity of construction to the western portions of the communities. The construction of the transitway would require extensive pile driving and use of heavy equipment to excavate and remove materials. The major demolition operation required to tear down the existing Highway would also produce noise. There would be disruption of traffic prior to completion of the new roadway. Auto trips displaced from the existing Highway would probably divert to both FDR Drive and to the local north-south avenues adjacent to the existing roadway. This would result in some increase in noise levels adjacent to these roads. While the latest techniques and equipment using the most modern noise suppressant technology would be used, there would be an unavoidable increase in noise levels in the Project area during the demolition operations. The noise problems would be of longer duration than for the Maintenance alternative.

Inboard

The Inboard alternative would result in the maximum construction-related noise impacts. The sources of noise created by this alternative would be essentially the same as those previously discussed for the Arterial alternative—namely, increased noise levels due to pile driving and demolition of the existing Highway and disruption of traffic.

However, construction of the Inboard would involve much more extensive pile driving even closer to the western edges of the communities than would be required for the Arterial. Extended periods of pile driving would be required in West Street and in the corridors for the Holland and Lincoln Tunnel interchanges, as well as along the transitway route north of 23rd Street.

Outboard
While the Outboard alternative, like the Inboard, would have substantial portions of the roadway built as covered and ventilated sections, it would have considerably less construction-related noise impact. The reason for this is that major sections of the Outboard roadway would be built on landfill at the pierhead line. Consequently, the distance between most of the construction noise sources and noise-sensitive uses, such as schools, residences, churches and playgrounds would be large, and the construction-related noise levels at these sites would be low. Also, the phasing of construction for the Outboard alternative would enable the existing highway to remain in place until construction of the new roadway was almost complete, and would result in little disruption of traffic.

Effects on Air Quality

Major construction activities inevitably involve some impact on the air quality of the construction site and, possibly, in adjoining areas. These impacts during construction come from three sources. First, dust and other particles carried into the air by construction and demolition operations. These particles may remain air borne for several hours and, depending on meteorological conditions, may settle some distance from the construction site. Second, motor vehicle generated pollutants such as carbon monoxide, hydrocarbons, nitrogen oxides and particulates which are emitted from the construction and demolition equipment, usually powered by gasoline or diesel engines. Third, increased vehicular emissions due to the rerouting of traffic during construction and demolition. Such rerouting may cause trips to be both longer than they were before and made at slower speeds which would increase pollutant emission rates.

Ameliorative measures against all of these impacts are available and in wide use in the construction industry. Such measures include dust control through watering and covering procedures, emission control devices on construction equipment, and extensive traffic maintenance procedures. Generally, it may be expected that during the construction period, air quality in the immediate vicinity of the construction sites would deteriorate slightly, but in a controlled manner and without undue excesses. Whenever and wherever air quality impacts could be avoided, every measure would be taken to protect the quality of the air around the construction sites. The exact extent of these construction-related impacts would vary from alternative to alternative, and would apply only to the construction phase. Following is a qualitative comparison of the construction-related air quality impacts of each of the alternatives.

Maintenance
The principal air quality impact from the Maintenance alternative would occur from the rerouting of traffic from the West Side Highway during maintenance procedures. As mentioned above, the City expects that extensive maintenance and repair procedures would be a regular occurrence by the early 1980's, and would be more frequent thereafter. Therefore, regular rerouting of West Side Highway traffic onto local streets can be anticipated for many years. This rerouting of traffic would cause increases in air pollutant levels, particularly carbon monoxide on those streets that would carry the major portion of the rerouted traffic. Because the rerouting would be carefully planned to use main north-south arterials, especially West Street, as alternative north-south corridors, it is expected that air quality impacts would be confined to those streets. Because the maintenance of the West Side Highway would continue for an indefinite period of time into the future, this alternative would produce a long-term impact on air quality.

Reconstruction
The air quality impacts of building the Reconstruction alternative would involve both direct impacts from dust and construction equipment pollutant emissions, and the secondary impacts related to traffic diversion during construction. The diversion of traffic during construction would be more extensive for the Reconstruction alternative than for the Maintenance alternative, because of the greater lengths of time and longer sections of the Highway that would be closed during reconstruction. It must be noted, however, that the Reconstruction alternative would be finished within a fixed period of time, and its construction impacts would not be of a long-range nature.

Arterial
The impact on the air quality of this alternative is related both to construction and the rerouting of traffic from the West Side Highway and West Street to local streets, for construction of the transitway. If the transitway is built in the Eleventh Avenue alignment, traffic on Eleventh Avenue between 20th and 30th Streets would have to be rerouted to local streets during construction. If the transitway is built in Twelfth Avenue, there would be an even more extensive detouring of the Twelfth Avenue and West Side Highway traffic to local streets north of 42nd Street, since the space available on Twelfth Avenue would be severely reduced by construction of the transitway. The rerouting of the traffic to local areas and the accompanying adverse effects on air quality would be more extensive for the Arterial alternative than for either the Maintenance or Reconstruction alternatives.

The direct construction impacts on air quality of this alternative may be the most severe of all the alternatives. This is because construction would take place directly in West Street at a position closer to the West Street building line. Where possible, construction equipment, materials deliveries, and other activities would be placed as far from the West Street building line as possible, thereby minimizing air quality impacts in the adjoining neighborhoods.

Inboard

The Inboard alternative would have the maximum construction-related impacts on air quality of all of the alternatives. These impacts would be from both construction activities and the necessary traffic diversion. Again, as for the Arterial, much of the construction work would take place directly in West Street. Extensive heavy construction procedures would be required, especially for the depressed sections. This use of heavy equipment implies increased air pollution. In general, heavy duty gasoline engines pollute more than light duty engines. Fortunately, most of the heavy construction equipment employed today uses diesel power, which is far less polluting than gasoline power. In addition, emission controls can be readily maintained on heavy construction equipment and contractual procedures can be established to insure such controls.

As described above, major traffic diversions would be required during construction of this alternetive. These diversions would increase pollutant concentrations on those streets receiving the diverted traffic. Traffic air quality impacts would be most extensive during construction of the transitway which would require the greatest number of street closings and diversions of traffic.

Outboard

The construction of a new highway facility at the pierhead line would have the least effect on air quality during construction of any of the alternatives. The distance between the construction-related pollutant emission sources, and neighborhood activities is so large that direct air quality impacts would be small or non-existent. The movement of construction equipment and material delivery trucks could be maintained far from the eastern side of West Street. Temporary construction roads could be built on the landfill to avoid traffic disruption from the movement of construction equipment. These measures would serve to lessen air quality impacts from the movement of construction vehicles and other equipment.

Because the Outboard alternative would be built entirely outside of the right-of-way of the existing viaduct, the West Side Highway would be maintained in traffic service until the Outboard highway were completed and ready for service. Demolition of the viaduct would take place only after all traffic had been diverted to the new facility. Thus, traffic diversions and their concomitant air quality impacts would be only minimal during construction of the Outboard alternative.

Effects on Water Quality

Construction impacts on water quality would include the disruption of material dredged from the River bottom prior to landfill in the area, and possible increases in suspended solids resulting from placement of the landfill itself. However, such impacts would be associated only with the Inboard and Outboard proposals The probable impacts of construction of the Maintenance, Reconstruction and Arterial alternatives would be negligible.

One of the first items of work in both the Inboard and Outboard would be the removal of existing piers. The work would involve demolishing the headhouses, pier sheds, and pier decks, which would be removed from the area by barges and trucks. The pier foundations, most of which are timber piles, would then be removed. The removal of the piles would disturb the River bottom, and a small amount of bottom material would go into the main channel.

Inboard

The Inboard alternative would place landfill from about Houston Street to 14th Street. A permit would be required from the Army Corps of Engineers, which would specify locations for acquiring dredged fill material. Soil studies made in this area indicate that approximately five to fifteen feet of organic silt would have to be dredged and disposed of at sea with the permission and at a site approved by the Corps of Engineers. The dredging would be done so as to minimize the amount of sediment re-suspended in the River. Since the dredging area is well within the pier basins near the bulkhead, most of the re-suspended solids would settle out within the dredged area inside of the pierhead line. Filters or screens would be used to minimize any flow of re-suspended solids into the main channel of the River.

Outboard

The Outboard alternative would fill the inshore area of the Hudson River from approximately Harrison to 30th Streets from the bulkhead line to within 160 feet of the pierhead line. In the area beneath the location of the new highway near the pierhead line, material which is organic silt would have to be excavated, and the space refilled with granular material, to provide a firm foundation. Because of the large volume of material to be excavated under this scheme, the construction sequence would require the dredged material to be placed between the new fill and the present shoreline. There would be very little disposal of any of this material at sea.

The area between the highway and the bulkhead line, which would vary from 400 to 700 feet, would be filled first with the dredged material, and then with the granular material that would be excavated during the construction of the covered portions of the highway. A series of enclosed basins between the pierhead and bulkhead lines would be built using steel sheet piling. The dredged material would be carefully placed in these basins in order to avoid suspended material entering the River. Once the soft upper layer was removed, the firm organic material in the lower layers would be dredged and placed in the basins. This organic material would eventually be covered with the material excavated from the new fill in building the highway In the final phase, the entire area between the highway and the bulkhead line would be leveled to the approximate grade of West Street. Thus, there would be little intrusion of the deleterious material into the River, and there would be no excavation of the top surface of contaminated material between the highway fill and the bulkhead line. This material would be covered and buried, within the construction area. As with the Inboard, a permit would be required from the Army Corps of Engineers, which would specify locations for acquiring the needed fill material.

The detailed construction plans which would be prepared, should either the Inboard or Outboard alternative be selected for implementation, would specify measures to implement these methods, in order to provide maximum protection to the Hudson in the Project area.

Modifications for Changed Conditions

As discussed elsewhere, the initial planning for Project alternatives was carried out while the existing West Side Highway was in full operation. However, the subsequent collapse and closing of the Highway requires discussion of construction methods and impacts under the possibility that the Highway will remain closed to traffic.

This assumption would alter the scheduling, techniques and resulting environmental impacts of the construction program to a different extent for each alternative. A qualitative assessment was made in sufficient depth to determine the probable effects, but was not done to the same depth as the original work.

Therefore, it was assumed that the following conditions would exist at the time of construction of one of the Project alternatives.

- **The existing West Side Highway viaduct would be closed to traffic from 46th Street to Battery Park, with the Highway structure left in place.**

- **Existing West Street would have been resurfaced to serve as a continuous four-lane street from 46th Street to Battery Place, either adjacent to or under the existing Highway.**

- **Traffic formerly carried on the existing Highway would be traveling along other north-south routes on parallel thoroughfares.**

Maintenance

Substantial initial repair to the existing structure would have to be made in order to put the facility back into operation. There is a real possibility that the Highway will remain closed. Both the kind and extent of repairs necessary to reopen the existing Highway indicate the general nature of construction disruption and other impacts. Both previous experience in repairing the existing facility and its present condition, to the extent that it is now known, are strong indications of the type of work necessary to enable traffic to use the Highway once again.

The existing Highway has been showing the results of nearly 40 years of age and wear. Each year, both the cost and difficulty of maintaining the present viaduct in usable condition have increased, far beyond those normally associated with a comparable length of elevated roadway Deterioration of both the deck and the structural steel has been accelerating. For example, the section between 56th and 72nd Streets was repaired on an interim basis between 1966 and 1968, and full structural rehabilitation began in 1971. Since 1970, holes in the deck averaging 18 inches in diameter have proliferated along the entire length of the Highway. Inspections of the exposed reinforcing steel on the underside of the roadway have indicated that such holes will continue to appear more frequently. Steel plates are normally placed over the holes as a temporary repair, but when there are a series of plates over a short stretch of roadway, the roadway must be replaced.

Pending the outcome of the inspection program being undertaken by the City and decisions on whether or not to repair the Highway between the Battery and Midtown, the City Departments of Traffic and Highways, are preparing a four-lane detour. This alternative route for traffic previously carried on the Highway will run from 46th Street to the Battery, beneath and alongside the existing elevated structure.

Reconstruction

In the area between Battery Park and 42nd Street, the initial construction plan for the Reconstruction alternative would have four lanes of traffic on the existing Highway or temporary structures, while the existing structure was being rebuilt. However, assuming that the existing Highway remains closed, then all traffic would be traveling on other north-south streets south of 46th Street. Because of the relative ease of working on a structure wholly free of traffic, the work on the viaduct could be completed in six years instead of nine years. Such a time saving would, of course, substantially reduce the probable impacts of the construction program itself. Simply, there would be three years less of adverse effects on air quality and noise levels.

In the area between 42nd and 72nd Streets, the Reconstruction alternative would demolish the entire existing Highway viaduct, and replace it with a completely new elevated structure in the same right-of-way. Assuming either an open or closed Highway from 42nd to 72nd Streets, construction methods and timing for this section would be the same. In either case, the existing facility would have to be completely closed down between 42nd and 72nd Streets during construction. All traffic would be detoured to local avenues for three to four years. Thus, there would be no difference in probable environmental impacts attributable to construction of this alternative, whether or not the existing Highway is operating in this area.

Arterial

There would be no substantial differences in construction of the entire Arterial between Battery Park and 72nd Street, whether the existing West Side Highway were open or closed upon implementation. Therefore, the probable environmental impacts due to construction itself would be the same in either case.

Inboard and Outboard

For both Inboard and Outboard alternatives, the principal effect of the existing Highway remaining closed would be the demolition of the present viaduct at an early stage of construction, advancing completion of work to rebuild West Street. This would ease the problem of maintaining north-south traffic on the West Side. In addition, for the Outboard, both the highway and transitway could be built in the same stage of construction and north-south traffic would probably be attracted from upland local avenues to the new surface route, while construction continued on the new highway facility. The latter effect would be somewhat stronger for the Outboard than for the Inboard alternative. However, the overall time saving for either Inboard or Outboard would range between one and two years.

Costs

Detailed cost estimates have been prepared for each of the alternatives. The Inboard and Outboard alternatives were estimated from the Brooklyn-Battery Tunnel to the vicinity of 42nd Street, while the Arterial, Reconstruction and Maintenance were estimated from the Brooklyn-Battery Tunnel to 72nd Street.

The costs were determined by estimating quantities of the major items of work required for each alternative, and applying current unit costs to these items. Major items of work include: excavation, dredging, embankment, stone fill, sand drains, riprap, pre-stress and pre-cast piles, concrete, pre-stressed concrete beams and structural steel. Added to this base cost was approximately 25 percent for mobilization, surveys, engineering and contingencies for the alternatives including an interstate facility, and 30 percent for the Reconstruction and Arterial alternatives.

Items of work required for the Reconstruction alternative were based upon assumptions of the numbers of beams, stringers, and steel bents which would have to be replaced. The assumptions have been made with the assistance of the New York City Department of Highways. They do not represent the findings of a detailed inspection of the structure.

The costs of the Outboard, Inboard, Arterial and Reconstruction alternatives were developed by the Project staff. The estimate for repairing the existing structure to operational standards, the Maintenance alternative, was developed by the City and State of New York. More details on costing procedures and unit costs is found in the **West Side Highway Project Design Report,** and the **Manhattan West Side Corridor Transit Study Technical Report.**

Right-of-way estimates for each of the alternatives have been prepared by the Real Estate Division of the New York State Department of Transportation. Based upon the plans for each alternative, the potential impact on affected properties was estimated. Where a partial impact of the facility on a particular property occurred, the percentage of damage was established. The market value of the property affected was estimated, to which the following items have been added: interest for one year from taking title; appraisal costs; a condemnation factor of 12 percent; and miscellaneous costs such as title abstracts and relocation assistance.

The accompanying table displays the estimated costs for the highway components of each alternative in 1973 dollars. The Inboard and Outboard alternatives extend only to 42nd Street, while the Arterial, Reconstruction and Maintenance alternatives go north to 72nd Street.

Three of the alternatives—Arterial, Inboard and Outboard, include transit systems. Costs for the transitways were developed for the Manhattan West Side Corridor Transit Study using the same methodology described above. The three highway-transit alternatives have been designed to accommodate either a busway or a rail system. In addition, the busway has been designed to be convertible to rail. For the purposes of this section, the busway has been included in the Inboard and Outboard alternatives, and the rail system has been incorporated into the Arterial alternative.

The proposed transitways would extend beyond the Project study area. Construction of both transitway and highway would be concurrent along the length of the transportation corridor. The express bus system proposed as part of the Inboard and Outboard alternatives would extend from the World Trade Center to near the George Washington Bridge, although the highway facility would go north only as far as 42nd Street. The proposed rail transit line, included as part of the Arterial up to 42nd Street, would extend from the World Trade Center to the George Washington Bridge, where it would cross Manhattan into the Bronx and extend north to Van Cortlandt Park. A branch line would extend along 145th Street across Manhattan to the Grand Concourse in the Bronx. The rail system also includes connections to the existing New York City subway system at 14th and 41st Streets.

The Transit Study has developed the proposed transitways and the following cost estimates.

Table 78 **Highway Construction and Right of Way Costs**
In millions of dollars

Alternative(a)	Battery—42nd Street		42nd—72nd Streets		Total	
	Construction	Row	Construction	Row	Construction	Row
Maintenance	56	0	30	0	86	0
Reconstruction	148	8	79	4	227	12
Arterial	45	0	31	0	76	0
Inboard (I_1)	887	55			887	55
Inboard (I_2)	909	73			909	73
Inboard (I_3)	894	56			894	56
Inboard (I_4)	916	75			916	75
Outboard (O_1)	1139	102			1139	102
Outboard (O_2)	1174	111			1174	111
Outboard (O_3)	1136	129			1136	129
Outboard (O_4)	1165	85			1165	85

(a) I_1 Lincoln Tunnel interchange at 30th Street, and transitway in Eleventh Avenue.
I_2 Lincoln Tunnel interchange at 35th Street, and transitway in Eleventh Avenue.
I_3 Lincoln Tunnel interchange at 30th Street, and transitway in Twelfth Avenue.
I_4 Lincoln Tunnel interchange at 35th Street, and transitway in Twelfth Avenue.
O_1 Lincoln Tunnel interchange at 30th Street, and transitway in Eleventh Avenue.
O_2 Lincoln Tunnel interchange at 35th Street, and transitway in Eleventh Avenue.
O_3 Lincoln Tunnel interchange at 30th Street, and transitway in Twelfth Avenue.
O_4 Lincoln Tunnel interchange at 35th Street, and transitway in Twelfth Avenue.

Table 79 **Transitway Construction and Right of Way ROW Costs**
In millions of dollars

	WTC(a) to 22nd Street		22nd to 42nd Street		42nd to 72nd Street		Balance of System		Total	
	Transitway	Row	Transitway	Row	Transitway	Row	Transitway	Row	Transitway	Row
Express Bus										
Outboard 11th Ave.	$ 213	(a)	$ 63	$ 7	$ 19	$ 11	$ 155	$ 6	$ 450	$ 24
Outboard 12th Ave.	207	(b)	53	(a)	116	2	155	6	531	8
Inboard 11th Ave.	155	(b)	69	7	19	11	155	6	398	24
Inboard 12th Ave.	158	(b)	62	(a)	116	2	155	6	491	8
Rail Transit										
Arterial 11th Ave.	194	(b)	156	17			754	11	1104	28

(a) World Trade Center.

(b) Right of way costs included in construction costs for this alternative.

Table 80 **Approximate Annual Construction Costs**
In millions of dollars

Construction Year	Reconstruction	Arterial without Transit	Arterial with Rail(a)	Inboard with Busway(a)	Outboard with Busway(a)
1	$ 18	$ 9	$ 20	$ 92	$ 125
2	14	22	25	123	159
3	16	18	43	101	106
4	19	11	40	119	144
5	20	8	39	153	152
6	23	8	34	157	209
7	27		25	149	191
8	19		28	141	165
9	24		24	53	112
10	19		29	23	52
11	19				
12	9				
Total	$ 227	$ 76	$ 307	$ 1111	$ 1415

(a) Transitway in 11th Ave.

Construction schedules have been developed by the Project staff for the associated highway and transitway alternatives, within the designated Project area. The duration of construction varies from six years for the Arterial without transit, to 12 years for Reconstruction. The following table shows an estimated annual construction cost for those alternatives. The table does not include schedule or costs for the portion of the transitway which would extend north of 42nd Street, beyond the designated Project boundary.

Summary of Probable Impacts

Competing interests and differences in priorities are inherent in any major undertaking, such as improving transportation facilities on the West Side of Manhattan.

It is recognized by the Steering Committee that environmental quality, social amenities, economic growth, and transportation benefits are all legitimate, if competing, concerns of the public. Attempts to maximize any one of them will often conflict with the achievement of others. Providing an optimum condition within the West Side corridor will necessarily and properly reflect the balancing of various values. Such choices will be determined in concert with the persons, communities and organizations affected by the Project.[77]

The probable impacts of the five Project alternatives can be readily identified as either adverse or favorable, short-term or long-term, avoidable or unavoidable. Each is examined in order to assess whether irreversible adverse impacts curtail the range of potential future uses of the environment.

Each particular impact has definable characteristics by which beneficial or adverse effects can be determined. For example, all air, noise and water quality conditions which would either exceed Federal standards or existing conditions are considered adverse. Any land-use configuration which would cause or perpetuate undesirable results in terms of community disruption, reduction of open space and needed public facilities, or traffic congestion, is considered adverse. On the other hand, any existing condition which would be improved by a transportation alternative is considered to have beneficial impacts.

Assessment of adverse impacts includes consideration of abatement or corrective measures which are economically prudent, technologically feasible, safe and generally effective. Any adverse impact requiring an abatement measure outside these guidelines is considered unavoidable.

The extent to which the Project alternatives involve possible trade-offs between short-term uses of man's environment and the maintenance and enhancement of long-term productivity of the environment is also considered. Without defining specific time limits, short-term impacts are those which would have an immediate or direct consequence for the Study Corridor and surrounding area, including construction periods. Long-term effects are those which would primarily affect future generations.

Any one of the five Project alternatives would cause certain unavoidable impacts, requiring irretrievable and irreversible commitments of resources that would limit the available future options on the West Side and in Manhattan. In such cases, potential uses of the Corridor are constrained in different ways, given the configuration of each alternative.

Traffic and Transportation

Each proposal would provide long-term beneficial impacts on traffic, except for the Maintenance alternative. Repairing and maintaining the existing highway for more than 20 years into the future would result in increased congestion and worsening traffic flow conditions on the highway and the Corridor local streets. Vehicle speeds on both the highway and local streets on the average would decrease significantly, and congestion and its resulting effects would increase. These conditions are both short-range and long-range adverse impacts.

The Reconstruction alternative would improve safety and permit higher speeds by the elimination of curves, relocation of ramps and provision of shoulders. Traffic flow would be improved during off-peak-hours, but traffic demand would still exceed capacity during peak hours. Extensive use of a proposed traffic surveillance and control system would be necessary to prevent extreme congestion. Queuing would tend to occur on approach streets.

The Inboard and Outboard alternatives would provide safe highways with increased capacity. Peak-hour speeds would increase substantially and peak-hour congestion would decrease, particularly in the section between Canal and 42nd Streets. There would be some traffic flow problems, however, at each end of the highway. In the section north of 42nd Street, the quality of evening peak-hour flow would decline as traffic moves from the new, higher capacity West Side Highway to the lower capacity Henry Hudson Parkway. A similar situation would occur near the Brooklyn-Battery Tunnel during the evening peak hours, when West Side Highway traffic moves south into the tunnel. Peak-hour flow would be slightly better with the Outboard alternative because its alignment would produce slightly lower peak-hour volumes. To make certain that desirable flow conditions are maintained and full use is made of either the Inboard or Outboard facility, ramp metering and diversion would be implemented through the traffic control system. The location of ramps and the expanded capacity of West Street would facilitate these controls.

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[77] **Policy Statement of Steering Committee,** West Side Highway Project Report No. 2.01, August 1972.

Local Street System

Compared with the Maintenance alternative, the Reconstruction and Arterial alternatives would not significantly improve traffic conditions on study area streets. Conditions near the Hudson River tunnels would continue to be extremely congested during evening peak hours. The reconstructed highway and the Arterial boulevard would be unable to attract significant auto traffic from the local system, primarily because no significant increases in mainline capacity would be provided. However, because of the numerous exits and entrances on the Arterial mainline and the favorable flow conditions during off-peak hours, some short trips might be diverted from local streets during these hours. The attractiveness of high speeds and uncongested conditions on either an Inboard or Outboard highway would divert sufficient traffic from the local system to increase peak hour average speeds. Also, provision of direct ramp connections between the tunnels and the highway would reduce the amount of congestion on nearby local streets.

By allowing trucks on the highway, the Reconstruction alternative would reduce the volume of truck traffic (measured in truck vehicle-miles of travel, or VMT) on the local streets in the study area by approximately nine percent compared with the Maintenance alternative. The mainline in the Arterial alternative (West Street) would divert sufficient truck traffic from other local streets to reduce their daily truck VMT by about six percent.

Either the Inboard or Outboard alternative would reduce truck traffic on local streets by approximately 9 and 12 percent, respectively. This would occur primarily because of the attractiveness of increased speeds and reduced congestion on the highway. Total vehicle-miles of truck travel in the impact area, however, would increase slightly as a result of the longer paths for diverted trips. Because of the location and design of the 14th Street interchange, this increase in truck VMT would be smaller with the Outboard alternative.

Parking

The provision of transit service in the Arterial alternative would increase the potential to restrict parking availability. Implementation of this alternative would also eliminate the truck parking spaces currently under the existing West Side Highway. This would have a significant impact in the areas near the Gansevoort-14th Street Meat Market, and near the Union and Saint John's truck terminals.

With either the Inboard or Outboard Alternative, the proposed transit service would attract suburban riders away from automobile transportation and increase the potential for limiting parking availability. There would also be a substantial reduction in the parking spaces available for trucks in the highway corridor, although some spaces would be provided near the meat market.

Neither the Reconstruction nor Maintenance alternatives would offer any further opportunity to restrict the availability of parking spaces.

Transit

No transit system is included in the Reconstruction or Maintenance alternatives. The Arterial, Inboard and Outboard alternatives provide for a transitway which could accommodate either rail transit or express bus service.

The rail rapid transit system which would extend from the World Trade Center in Lower Manhattan to Van Cortlandt Park in the Bronx would serve primarily city transportation markets. By 1995, the rail transit option would carry 157,244 passengers with trip destinations in the Manhattan Central Business District. Approximately 9,000 (5.7 percent) of these passengers would have been diverted from automobile transportation.

The transit alternative featuring express buses with exclusive bus lanes would provide primarily commuter service between outlying counties and boroughs and the Manhattan CBD. The variations in projected ridership results from differences between the number and location of access ramps between the busway and local streets. The ridership is predicted to range from 68,000 passengers with trip destinations in the CBD to 82,000 passengers. Approximately 15 percent of these passengers would have been diverted from automobile transportation.

Social and Economic Effects

Economic

The Region, the Manhattan Central Business District and the West Side would experience long-term benefits from the provision of improved access to the CBD, thereby reducing the cost of doing business in the CBD and helping to retain or attract job-intensive industries. These benefits primarily are associated with the Outboard, Inboard and Arterial alternatives, each with a transitway. Each alternative would also generate jobs and cash flow in the area in proportion to its cost and complexity—the Maintenance alternative providing the least benefits, the Reconstruction, Arterial, Inboard and Outboard alternative each increasing such benefits over the other, respectively. Because the economy of the New York Region is heavily dependent upon the Manhattan CBD, the Region would share whatever adverse impacts affect Manhattan.

Within the Study Corridor, most industries either involve trucking or are dependent upon transportation services. Thus, the Inboard and Outboard alternatives, which would improve general accessibility to the West Side, would also provide the most benefits. The Lower Manhattan office industry would particularly benefit from the transit elements of the Arterial, Outboard and Inboard alternatives. Other industry might benefit from a reorganization of their operations—for example, the meat market under the Outboard alternative, or from the consolidation of their operations—for example, the cruise ship portion of maritime activities, the freight forwarding portion of the trucking industry and the railroads.

Short-term and long-term adverse impacts would be created for businesses depending on truck parking areas under the elevated highway or in adjacent publicly-owned wharf space. The Outboard, Inboard and Arterial alternatives would eliminate such space. The Maintenance and Reconstruction alternatives would maintain such space.

Social

Overall, the Project alternatives would influence but not directly cause short-term and long-term impacts on Corridor characteristics, in terms of trends in population, employment, housing and the provisions of public facilities and services. The trends would be stimulated in the short and long term by the Arterial, Outboard or Inboard alternatives. The most significant potential long-term effect is the redistribution of population, and public facilities and services depending on City policy toward the development of land which would be created by the Outboard alternative. The Maintenance and Reconstruction alternatives would reinforce the retention of current land uses in their present locations.

The Maintenance and Reconstruction alternatives would perpetuate the existing negative impacts on the West Side that are attributable to an elevated highway structure that forms a physical barrier between adjacent communities and the waterfront, and that inhibits new development or redevelopment of the area.

The Arterial alternative would have short-term and long-term beneficial impacts, through the removal of the elevated highway and replacement with a new roadway and transit facility. Short-term and long-term redevelopment along the West Village waterfront and other areas of the Corridor would depend upon development and redevelopment policies of the City, particularly for off-shore areas no longer needed for maritime purposes.

The Inboard alternative would allow for more orderly redevelopment by virtue of the extended period of time for project implementation. Improved access to the waterfront south of 14th Street, expanded recreational and open space areas, incentives for new housing development in the West Village and improved environmental conditions would be long-term benefits.

The Outboard alternative also would allow for orderly development and redevelopment over the long term, with an emphasis on the opportunity for developing housing, parks, open space and community facilities on the newly created land. The opportunity for long-term benefits is substantial, depending on the development policies and programs which would have to be developed over time if the Outboard is selected for implementation.

The physical separation of the waterfront from the local communities, perpetuated by the Maintenance and Reconstruction alternatives, would be adverse and unavoidable over the long term. The limitation on new development and redevelopment would inhibit achieving city and community goals, except in the Chelsea area where the goal of revitalized maritime activities is desired. No alternative would significantly assist in attaining that goal.

Parks, Open Space and Recreation

The alternatives would have impacts ranging from no effect to substantial improvement over the existing conditions. Overall, the alternatives with the greatest short-term adverse impacts are the ones which would create the greatest long-term benefits. Conversely, the alternatives with the least short-term adverse impacts would also create the least long-term benefits.

The long-term beneficial effect of the Outboard and Inboard alternatives, respectively, would be to improve the amount, quality and availability of needed open space and recreational areas on the West Side. These alternatives would substantially change the physical configuration of the waterfront, creating opportunities for developing new waterfront parks and recreation areas.

The Reconstruction and Arterial alternatives, although not significantly increasing the amount of open space, would provide for the relocation of an existing park in a more desirable and useful location. The Maintenance alternative would not physically alter the waterfront or existing open space and park land.

The Maintenance, Reconstruction and Arterial alternatives would have long-term adverse impacts, to the extent that they would perpetuate the physical separation of the adjacent communities from the waterfront area. They also would have the effect of perpetuating open space, park and recreational areas where short and long-term impacts of noise and air quality would be most severe.

Short-term unavoidable impacts on open space, parks and recreational areas would occur during the construction period for all alternatives. The short-term effects would be most severe for the Outboard alternative, somewhat less for the Inboard alternative and least for the Reconstruction, Arterial and Maintenance alternatives. The short-term adverse impacts could be mitigated but not eliminated by providing temporary replacement space and temporary access.

The short-term and long-term adverse impacts on aesthetics or the visual environment would be most severe for the Maintenance and Reconstruction alternatives. The short-term and long-term effects of the Arterial alternative would be substantially improved. The Inboard alternative would have short-term adverse aesthetic impacts throughout the Corridor, but would have long-term benefits, except for the area north of 14th Street. The Outboard alternative would have short-term adverse aesthetic impacts throughout the Corridor during the construction period, but would provide the greatest long-term benefits.

None of the alternatives would irreversibly commit resources to the extent that potential development of future open space and recreational areas would be prevented. The Outboard and Inboard alternatives, respectively, would actually create the beneficial space. The Maintenance, Arterial and Reconstruction alternatives would not prevent the future development of waterfront open space, park and recreational areas, but all would inhibit such development.

Air Quality

The implementation of any of the five alternatives would have neither beneficial nor adverse long-term effects of significance on air quality from a regional standpoint. Regional emissions of hydrocarbons and nitrogen oxides are expected to decrease substantially in the future as a result of emission control regulations on motor vehicle manufacturers, as promulgated by the United States Environmental Protection Agency. The existing regulations and those which evolve in the future will be the controlling factors.

Within the New York Region, the Manhattan CBD and the West Side Study Corridor, the short-term effects on air quality would be a function of the officially approved Air Quality Implementation Plan and any future changes in its transportation control strategies. In the long-term, the effects would result from a number of factors, including emission control regulations on motor vehicle manufacturers, the amount and distribution of population and employment, the amount and quality of public transportation, City development and redevelopment policies with emphasis on the amount of parking space available, and particularly controls on trucking and truck traffic.

The alternatives would have varying degrees of beneficial and adverse effects on the amount of carbon monoxide in the air within the Corridor. At a predicted level of traffic in the future, assuming only the continuance of parking controls, the Outboard and Inboard alternatives, respectively, would have the most beneficial effects on air quality from a standpoint of carbon monoxide. This would result from the diversion of traffic, particularly trucks, from the local street system and the mechanical ventilation of the covered sections of highway. Thus the Outboard and Inboard alternatives would have the least adverse impact on air quality in the long-term for the areas immediately adjacent to the highway, as well as the Study Corridor impact area.

In general, the Arterial alternative would create conditions which would result in the most adverse carbon monoxide impacts throughout the Corridor, although the impacts would vary from site to site. The Arterial alternative is followed respectively by the Reconstruction and Maintenance alternatives in degree of adverse impact, again depending upon specific sites

Water Quality

No alternative would have a major long-term impact on the water quality of the Hudson River, although there would be a contribution to water quality improvement in the long term by the Outboard and Inboard alternatives, respectively.

In the short-term, adverse impacts would be caused during the construction phase by the Outboard and Inboard alternatives, although these would be mitigated by controls on construction methods and equipment.

The Outboard alignment would reconfigure the West Side shoreline, providing a smooth edge, consequently improving flow rates and dispersion of pollutants. Siltation would be retarded along the waterfront and the marine habitat would benefit from improvements in dissolved oxygen levels, thereby supporting more varieties of estuarine species.

Although the Inboard alternative would retain some finger-pier structures, partial smoothing of the shoreline in the expanded inter-pier basins would provide some long-term benefits. Both of these alternatives would relocate and improve existing sewer outfalls, improving flow rates and pollutant dispersions.

The Maintenance, Reconstruction and Arterial alternatives would have no significant impact, either positive or negative, upon water quality. The primary factor adversely affecting the water quality is the City's combined storm and sanitary sewer system. None of the alternatives would directly affect this fundamental problem.

The unavoidable adverse impact caused by automotive-source water pollution in the form of highway run-off is virtually insignificant, considering its percent contribution to the total street run-off of Manhattan's West Side and the existing problem of occasional untreated discharges into the Hudson.

The Project alternatives would not cause any irreversible commitments of resources adversely affecting the long-range options for improving the quality of the Hudson River.

Noise

Prediction of future noise levels in the West Side Study Corridor, and comparison with existing noise levels, indicate that noise reductions would be achieved in the long term in certain areas. However, the reductions would result primarily from the noise emmission characteristics of vehicles. Future noise levels, considered both short-term and long-term adverse impacts, would be significant for any alternative. Existing and predicted future noise would result in levels above Federal Highway Administration standards, which are established uniformly for both urban and rural areas.

In general, the Outboard alternative would result in the least long-term adverse impact, primarily because of long sections of the highway and transitway which are covered and ventilated. This alternative is followed in least long-term adverse impacts by the Inboard alternative for most of its length from the Brooklyn-Battery Tunnel to 14th Street.

The Maintenance alternative, primarily because it would provide for no truck traffic on the highway facility, would have the least adverse noise impact in the immediately adjacent areas. The Reconstruction and Arterial alternatives, respectively, would have the most severe long-term adverse noise impacts in the immediately adjacent areas.

For each alternative except Maintenance, abatement measures would be undertaken to either correct or minimize adverse noise impacts in most areas. However, exceptions to compliance with noise standards would be requested for those adversely impacted sensitive sites where there is no practical or feasible way to overcome noise levels above standards.

Short-term adverse impacts would primarily result during the construction phase of any alternative. Noise from construction, regardless of alternative, would be required to meet the limits of the New York City noise code. The alternatives which require the greatest amount of construction and the longest construction period would have the greatest short-term adverse impacts. These would be, in order, the Inboard, Outboard, Arterial with transitway and Reconstruction, and the least adverse impact would result from merely repairing and re-opening the existing West Side Highway.

Energy

There is no significant difference among alternatives in the irreversible or irretrievable commitment of energy resources. The maximum difference in energy consumption within Manhattan for any alternative is within one percent of the Maintenance alternative.

The commitment of energy resources for the exclusive busway transit option would be offset by a nearly equal savings in energy consumption, through the diversion of less energy-efficient auto passenger trips to the new bus system.

The commitment of energy resources for the rail transit option would be 1,227 billion BTU annually. However, only 21 percent of this would be returned in savings through diversion of auto passenger trips to the rail system.

Relocation

Housing, Business and Industry

The relocation of private and public properties under normal circumstances is invariably an adverse social and economic impact. The exception may occur when present conditions are undesirable and unacceptable. In those instances, relocation may provide the opportunity to create more desirable and beneficial conditions. The relocation of some commercial activities on the West Side from deteriorating structures to improved buildings and facilities could have a beneficial impact.

The short-term adverse impacts would include the disruption of social relations, unrecoverable indirect costs, and the inconvenience of changing living patterns and routines. Most such impacts are unavoidable, and have been minimized by selecting alternative locations which would require the fewest displacements. A long-term adverse impact might occur in a few instances where business activities could not be relocated satisfactorily, resulting in eventual business closings.

The Maintenance and Arterial alternatives would not cause any displacement of homes or commercial properties. The Reconstruction alternative would displace four buildings and relocate 13 commercial enterprises. The Outboard alignment, with a two-corridor interchange at the Holland Tunnel, would take a total of 47 buildings, causing the displacement and relocation of 89 families and 73 commercial enterprises. This alternative would displace 23 commercial tenants from the piers. The Outboard, with a single-corridor interchange at the Holland Tunnel, would displace 49 buildings, and necessitate the relocation of 96 families and 83 commercial enterprises.

The Inboard alternative, with a two-corridor interchange at the Holland Tunnel and a 30th Street corridor interchange at the Lincoln Tunnel would require 58 buildings (tenements, garages, lofts, warehouses), and would relocate 130 families and 88 commercial enterprises. In addition, there are 18 commercial tenants in the pier areas that would be relocated. The Inboard alignment, with a single corridor interchange at the Holland Tunnel and a 35th Street interchange for the Lincoln Tunnel would take 51 buildings (tenements, garages, lofts, warehouses), and displace 190 families and 74 commercial enterprises. It also would remove 21 commercial tenants from the piers.

Public Facilities and Utilities

The probable impacts on public facilities and utilities would be virtually all short-term, unavoidable and adverse, with only a few exceptions. Benefits would accrue to those public facilities which are outmoded and presently limited in space and accessibility, and which would be replaced as part of the implementation of the alternative.

Specifically, a long-term benefit of the Outboard and Inboard alternatives would be the functional replacemnt of the municipal Gansevoort incinerator with a more efficient and cleaner solid waste disposal facility. The existing incinerator plant consists of relatively obsolete technology generating substantial air pollution which is of concern to the local community. In addition, the Outboard alternative, and to some extent, the Inboard and Arterial alternatives, would facilitate the planned installation of a new 72-inch distribution water main under West Street-Twelfth Avenue by the City.

The short-term unavoidable and adverse impacts would result from the necessity for relocation and disruption of a myriad of underground utilities. The Maintenance and Reconstruction alternatives would have the least short-term adverse impact. The Arterial alternative with a transitway would be more disruptive. Both the Outboard and Inboard alternatives would involve major relocation of utilities.

Aside from the physical acquisition of space required for the new transportation facilities, the Project alternatives would not irreversibly commit resources which would foreclose future utility installations or public facility operations in the Corridor area.

In order to keep disruption and interference to a minimum, the following construction methods would be used for the extensive utility relocations anticipated for the Inboard and Outboard alternatives. First, existing sewer service would be maintained, except for the period necessary to interconnect the new relocated section with the existing system. This operation could be scheduled for the hours of least utility use. Second, the high and low pressure water mains would be kept in service at all times. The interconnection between the existing and the relocated sections could be made without interruption of service, by tapping under pressure. Third, the relocation of the air conditioning facilities at the World Trade Center could be started in the summer months and interconnections made during winter months, when air-conditioning facilities would not be in use.

Construction

The actual construction of a selected alternative would create temporary or short-term adverse impacts —the majority of which would be unavoidable. The adverse environmental effects would not all occur simultaneously in any one alternative, but would be spread over a considerable period of time. To the extent that a particular alternative would include construction work, the generation of jobs and income would be a short-term benefit.

During construction, traffic along the West Side waterfront would be disrupted. Construction techniques would require the movement of materials and debris, and the operation of equipment which would generate noise and dirt. These short-term impacts would be minimzed by specifying particular techniques, scheduling and incorporating the most advanced environmental safeguards during operations. Despite these efforts, some adverse impacts would be unavoidable.

In terms of noise and air pollution, the Inboard alternative would have the most substantial construction impact. The Arterial alternative would be next in severity, followed by the Outboard and Reconstruction alternatives. The Maintenance alternative would have the least impact. The Inboard, Arterial and Outboard alternatives would require the complete demolition of the existing West Side Highway, resulting in disruption of traffic and a minimal deterioration of air quality on the streets where this traffic diversion would occur.

Water pollution caused by disruption to bottom material during pier removal and dredging would occur prior to landfill operations, as well as possible increases in suspended solids resulting from placement of the landfill itself. These short-term unavoidable adverse impacts would be associated only with the Inboard and Outboard alternatives.

The construction requirements for manpower, materials, and energy resources required to build a particuuar alternative would represent an irreversible commitment of resources, which would otherwise be available for other purposes. The irreversible commitment of resources would range from small amounts for the Maintenance alternative to very large amounts for the Inboard and Outboard alternatives

The commitment of manpower, while considered an economic benefit to the New York Region for the short-term, could not be retrieved once committed. The estimated number of man-years for each alternative is 1,200 for Maintenance, 3,500 for Reconstruction, 4,000 for the Arterial, 15,000 for Inboard, and 20,000 for Outboard.

Although there would be some long-term salvage value from the materials used in any alternative, these would be slight, and the utilization of most materials must be considered an irreversible commitment of resources. The quantities and types of materials needed range widely from very small amounts to merely repair and re-open the existing Highway to major amounts of materials for the Inboard and Outboard alternatives, as detailed in the West Side Highway **Design Report**. Among the most important materials are steel and concrete. The tons of required steel estimated for each alternative are 60,000 for Inboard, 34,000 for Outboard, 40,000 for Reconstruction, and 7,000 for Arterial. No estimate was made for the tons of steel to do nothing but repair the existing Highway, pending completion of a detailed inspection. The estimated cubic yards of concrete for each alternative are 180,000 for Outboard, 100,000 for Inboard, 50,000 for Reconstruction, and 1,000 for Arterial. No estimate was made for just repairing the existing West Side Highway.

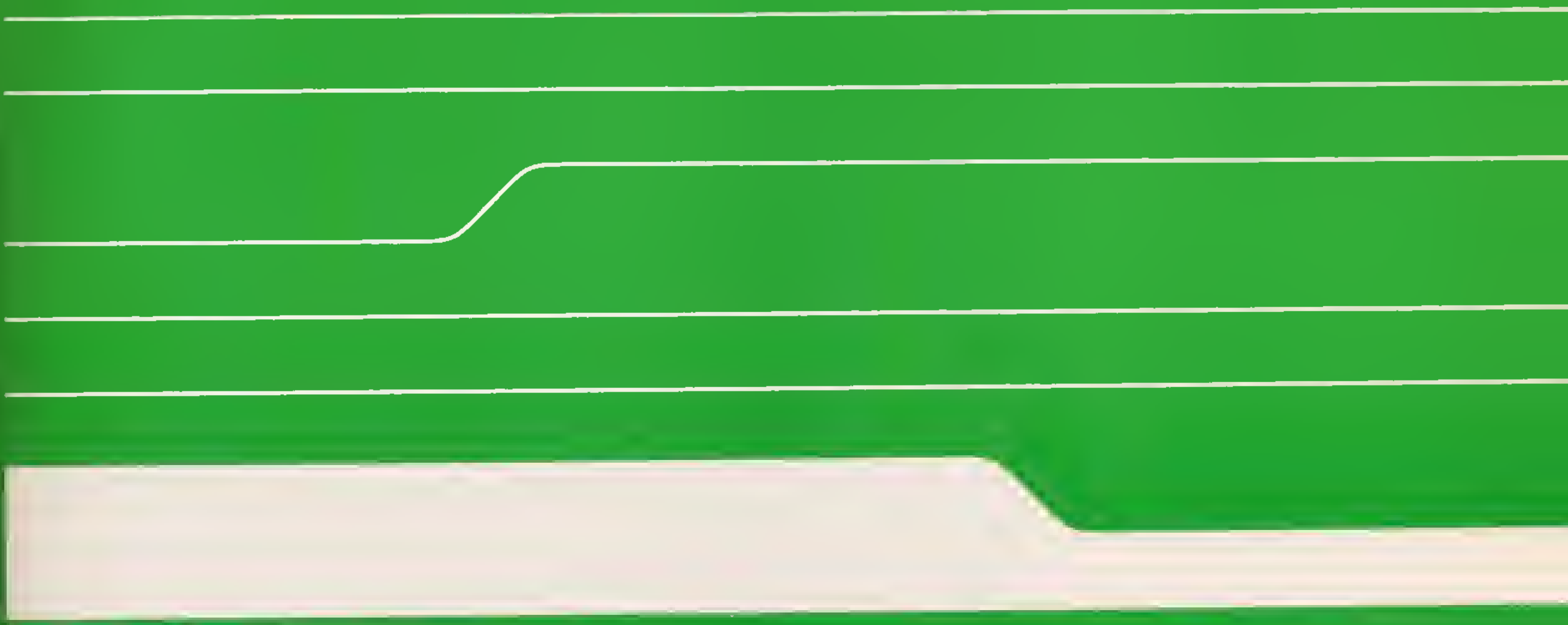
Conclusion

This summary of the probable beneficial and adverse effects of each alternative, and the more complete descriptions contained in other sections of this Statement, point up the complexity of the problems and issues which confront all participants in the decision-making process for the West Side Highway Project.

The five alternatives which have been presented here for consideration offer a wide range of possible actions and, therefore, a similarly wide range of potential impacts on the West Side and Manhattan. No single alternative can be shown to be beneficial in every category of social, economic and environmental effects. Nor can any one alternative be shown to respond positively and fully to the Goals and Policy Statements adopted by the Steering Committee at the outset of this planning process.

Consequently, this Enviromental Impact Statement emphasizes the fact that making choices in order to provide optimum future conditions within the West Side Study Corridor will necessarily and properly reflect the balancing of various competing values.

West Side Highway Project
Four (f) Statement on Park Lands



April 1974

Four (f) Statement on Park Lands

Introduction

The West Side Highway Project has developed alternative transportation proposals for the West Side of Manhattan for presentation at public hearing. The Project was created pursuant to a Memorandum of Understanding, between the Governor of the State of New York and the Mayor of the City of New York, in December 1971. It was organized to coordinate the interests of the local governments to improve transportation on the West Side, by replacing the existing West Side Highway, in the context of improving the deteriorating physical and economic conditions on the Hudson River waterfront of Manhattan.

The Project was charged with developing a wide range of transportation proposals. Policies, goals and objectives were set by a Steering Committee, which included City and State representatives, along with the Chairpersons of the Community Boards for the Community Planning Districts on the West Side. The Steering Committee also reviewed and guided the work of the Project staff in developing and refining the planning options

The Project is presenting at public hearings five planning alternatives, ranging from maintaining existing conditions to proposals which would dramatically alter the character of the West Side waterfront over the next quarter century. Each proposed alternative is presented as a "program package," a concept developed to incorporate compatible components for highway facilities, public transit and adjacent land uses.

Planning for the public transit components was undertaken as a coordinated effort by the West Side Highway Project and the Manhattan West Side Corridor Transit Study. The latter was funded by the Urban Mass Transportation Administration of the United States Department of Transportation, and was administered by the Tri-State Regional Planning Commission, in conjunction with the New York City Transportation Administration. Both studies utilized the same offices, in which interchange of information and coordination of effort were maximized. As a result, three of the Project proposals include a specially conceived "transitway" facility, designed to accommodate either express bus or rail transit service.

The existing West Side Highway, built mostly in the 1930's, is an elevated roadway which runs from the Battery at the southerly tip of Manhattan, northward along the Hudson River waterfront about six miles to 72nd Street, where it joins the Henry Hudson Parkway, which continues up to the George Washington Bridge. The existing structure is both geometrically obsolete and severely deteriorated, as was dramatically illustrated when a large section of the northbound roadway south of 14th Street collapsed in December of 1973. As a result, the existing Highway was subsequently closed down completely south of 46th Street, for an indefinte period.

The Manhattan waterfront between Midtown and Downtown areas, roughly between 42nd Street and the Battery, is presently occupied largely by old piers, almost all of which are either vacant, deteriorating or devoted to uses unrelated to the water. Maritime cargo operations are all but gone from the Manhattan side of the Hudson, while most passenger operations utilize facilities north of 42nd Street. The traditional economic activities of this West Side area, mostly freight handling, storage and movement by ship, rail and truck, are in a serious state of decline, which is forecast to continue.

However, recent thrusts of new housing development toward the River are now beginning to appear at various places along the West Side, although the existing Highway and the empty piers continue to provide both a physical and psychological barrier between the River and the local communities—Lower Manhattan, Greenwich Village, Chelsea and Clinton. One common characteristic of these West Side residential communities is the scarcity of park land, or open space, both in terms of absolute acreage, and in relation to present and projected population.

One consequence of the West Side deficiency in open space is that the Project alternative plans would affect at most only two small parks and one small recreational area on the West Side. However, approval of any alternative which would touch park land would be subject to a determination by the Secretary of Transportation pursuant to Section 4(f) of the Department of Transportation Act of 1966 (United States Code, Title 23, Section 138). Under such statute, use of publicly owned land from a park, recreational area, wildlife or waterfowl refuge, or historic site of national, state or local significance, as determined by the appropriate officials, is prohibited unless the Secretary finds that: (1) there is no feasible and prudent alternative to the use of such land; and (2) such program includes all possible planning to minimize harm resulting from any such use.

The existing West Side Highway and old Hudson River piers separate West Side communities from the waterfront.

Pursuant to this 4(f) requirement, this Statement outlines the proposed Project alternatives within the context of their respective impacts on those lands which have been classified as significant by the appropriate officials of the City of New York. This Statement first describes the three parcels of such 4(f) property which lie within the West Side Highway Project Study Corridor. It then summarizes the character of each of the five alternative proposals and sets out the nature of their probable impacts, if any, on the 4(f) lands. Finally, the Statement describes the Project planning efforts for minimizing any potential impacts upon the 4(f) lands

It should be noted that this discussion constitutes only the Section 4(f) Statement for the West Side Highway Project, with regard to potential disruption or displacement of park lands within the Project planning area by highway and transit proposals. The probable impacts of each of the alternatives upon the broader physical, social and economic environment of the area are presented in the West Side Highway Project Environmental Impact Statement. Although both statements have been printed and distributed together for the convenience of the public, each has been prepared as a self-contained document.

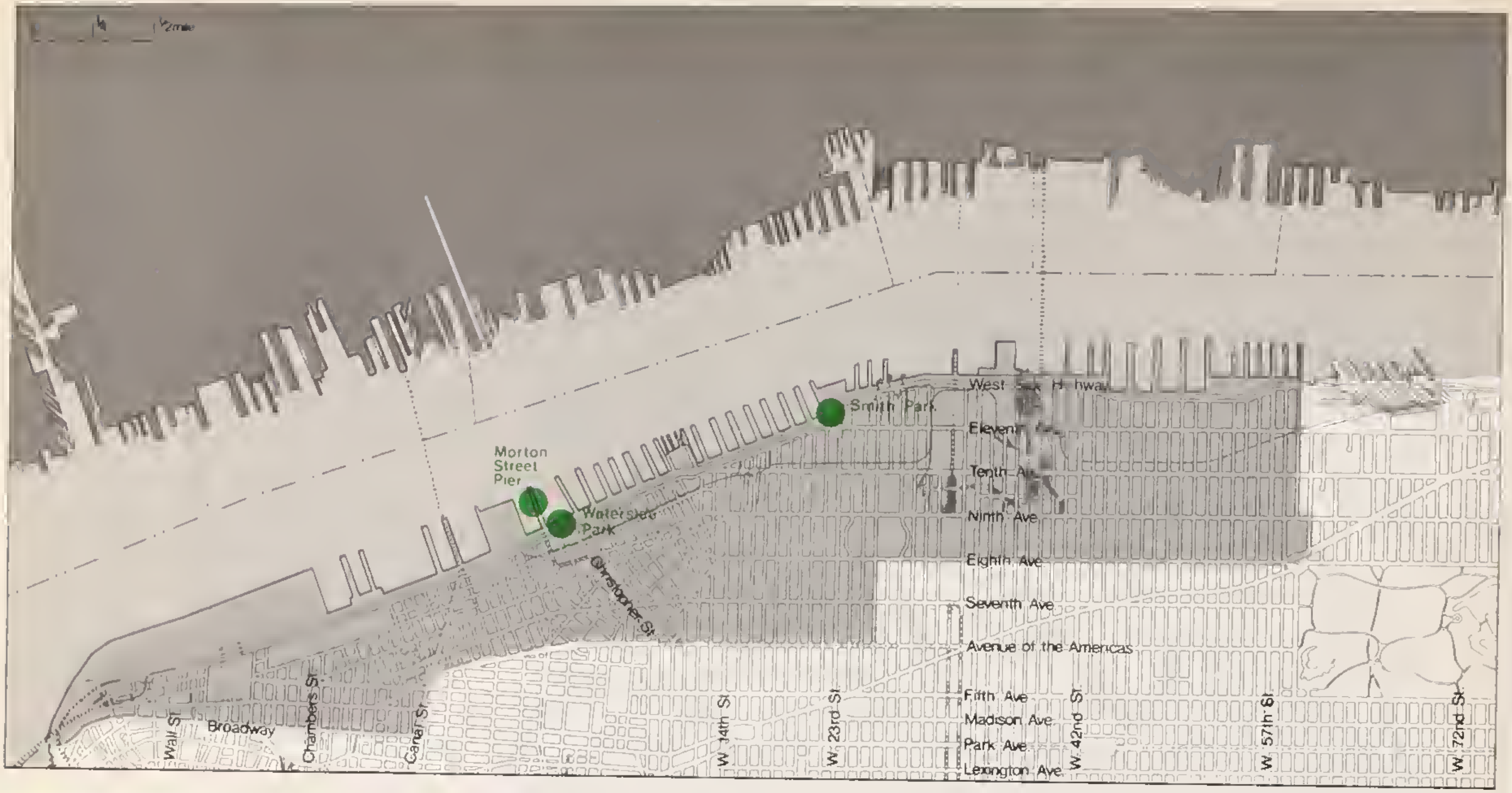


Illustration A Section 4(f) Park Lands in the Project Study Corridor

● Section 4(f) Park Lands

▨ Project Study Corridor

North

Significant Lands

The City of New York has classified three open space parcels in the Study Corridor as significant for Section 4(f) purposes, upon review of the West Side Highway Project planning associated with future open space and existing park lands in the area. The City determination appears at the end of this 4(f) Statement. One is Thomas F. Smith Park, located at 23rd Street and Eleventh Avenue, which is bridged by the existing Highway and bisected by access ramps. The other two parcels are located about a mile and a quarter further south along the waterfront. One is the Morton Street Pier, an old shipping finger-pier which has been cleared and opened to the public for recreation. The other is Waterside Park, a narrow strip of paved area which stretches a short distance along the waterfront, between the land end of the Morton Street Pier, and the existing Highway and West Street. All three locations are shown in Illustration A. No deed restrictions appear to exist for these properties, and none is subject to unusual characteristics of terrain, such as flooding.

None of these three facilities at present provides either very extensive or very desirable park space or recreational opportunities. Each is quite small, and configured and situated in such a way that its use is either severely constrained or impacted by nearby incompatible land uses. And this occurs in a context of West Side communities which are seriously lacking in park land.

The Study Corridor generally is quite deficient in recreational and open space, as well as within its constituent communities of Clinton, Chelsea and Greenwich Village. In 1970, there were only about 39 acres of parks and playgrounds in the entire Corridor south of 42nd Street, serving a total population of 84,000, as shown in Table A. This represents an average of only 0.46 acres per thousand persons. This is well below the existing Manhattan average of 1.42 acres per thousand, as well as below the Regional Plan Association goal of 0.60 acres per thousand for each community in Manhattan.

Except for a few major open spaces, such as Battery Park, DeWitt Clinton Park and Washington Square, most area recreational facilities are less than one acre in size. Furthermore, almost half the Corridor acreage is in Battery Park at the tip of Manhattan, well removed from existing residential concentrations in the Corridor. The details of existing open space conditions in the Corridor are contained in a special Project report, **Open Space Opportunities for the Lower West Side of Manhattan** (No. 5.20, November 1973).

Local residents are able to enjoy the waterfront at few places within the Study Corridor.

The alternatives proposed by the West Side Highway Project would involve a range of impacts upon the three 4(f) parcels in the Study Corridor, from no effect to total acquisition. However, in those instances where there would be negative impact upon 4(f) lands, Project planning has included the consideration of other actions which might either preclude or minimize any harm to the 4(f) lands. In addition, a major aspect of development of Project alternatives has been the attempt to create additional and better open space and recreational areas within the West Side communities, as well as opening up public access to the Hudson River waterfront.

Table A **Existing Park and Open Space in the Study Corridor Below 42nd Street in 1970**

	Acreage	Population	Acres per 1000 Residents
Lower Manhattan	23.54	540	43.5
Greenwich Village	7.78	37,485	0.20
Chelsea and Clinton South of 42nd Street	7.75	46,401	0.17
Total Study Corridor South of 42nd Street	39.07	84,426	0.46
Regional Plan Association Goal			0.60
Manhattan Average			1.42

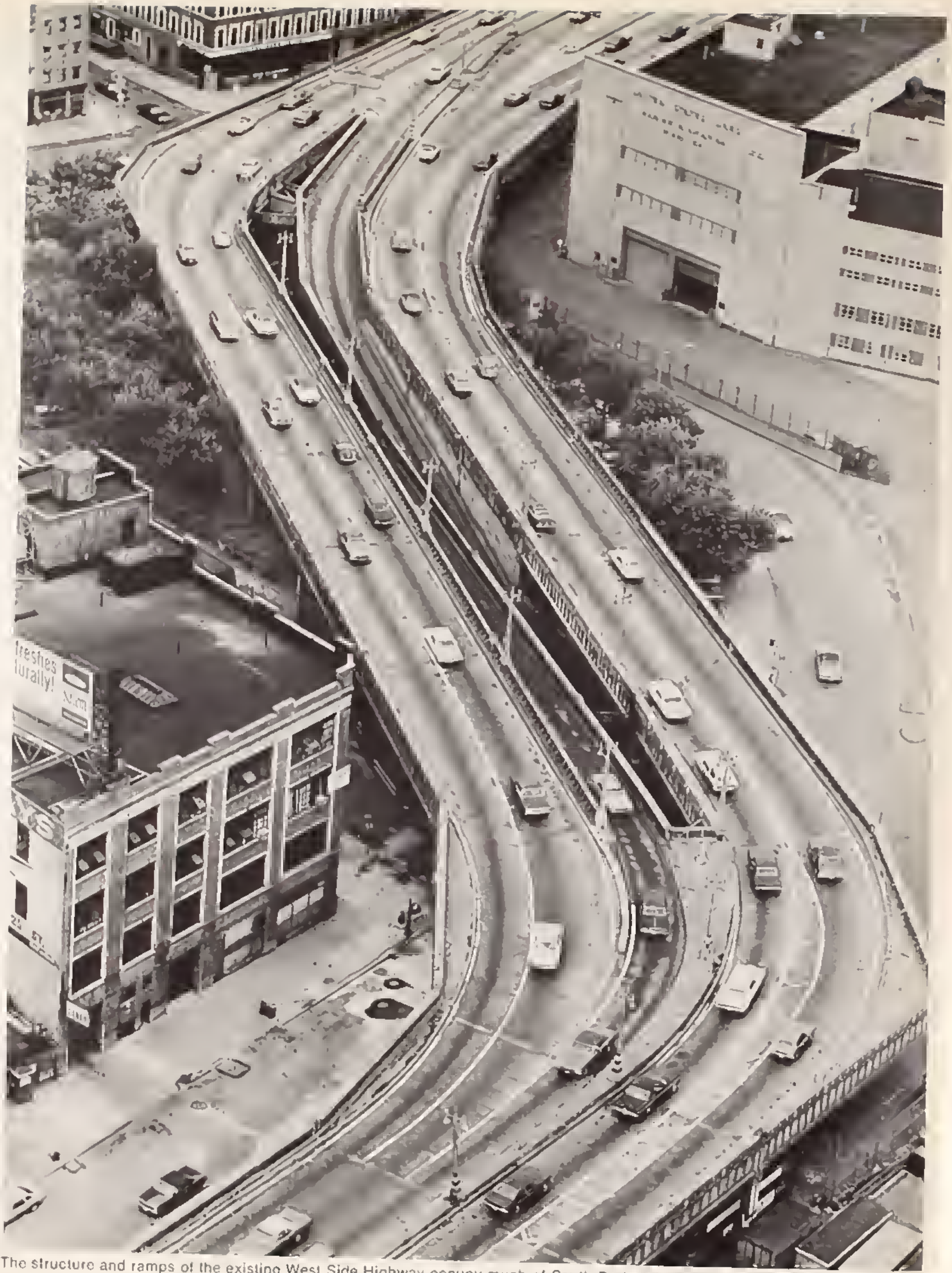
Thomas F. Smith Park

Thomas F. Smith Park is an officially designated park under the jurisdiction of the Parks, Recreation and Cultural Affairs Administration of the City of New York (PRCA). Located between Eleventh and Twelfth Avenues, and 22nd and 23rd Streets, in the Chelsea neighborhood, it is bisected diagonally from northwest to southeast by the main roadway elevated structure of the existing West Side Highway, and severed by the access ramps connecting the Highway to 22nd Street. In addition, a substantial piece of property within the legal boundaries of the park is occupied by West Street.

Smith Park contains 1.85 acres, but only part of that area is devoted to park uses. In addition to the space taken by West Street, the portion south of the Highway is used for car parking. Smith Park is shaded by 22 mature sycamore trees between 30 and 35 feet tall, mostly within the northern half of the site. The park area has an asphalt surface, and contains some benches, tables, concrete walks, a drinking fountain and a monument inscribed: "*In memory of Hon. Thomas F. Smith, Born 1863, Died 1923, Erected by the Seymour Club of Chelsea Neighborhood.*" Smith was a local public servant whose career spanned 30 years.

The history of Smith Park dates back to March 1907, when the City of New York acquired this property for the Department of Docks by condemnation proceedings. The Commissioners of the Sinking Fund (predecessor body of the Board of Aldermen, now the Board of Estimate) assigned the plot to the Department of Parks. However, this property was neither designed nor used as a park until 1936. A landscape and planting plan, dated December 29, 1936, envisioned trees, paths, swings, flagpole, iron picket fence, drinking fountain, underpass connecting the two park halves, tool house, monument, and horseshoe and shuffleboard courts. However, this plan was actually executed only in part.

Smith Park is located in an area zoned by City ordinance for manufacturing uses. It is in fact surrounded by light industrial uses, including garages, and truck rental and repair services. The 1972 assessed valuation of the site itself was $850,000, and an additional $1,000 for the improvements on the property.



The structure and ramps of the existing West Side Highway occupy much of Smith Park today.

Photo/New York Times

Non-recreational uses have been common to parts of Smith Park over the years, authorized by permits of the New York City PRCA. Beginning in 1951, and continuing today, one section of Smith Park just south of the existing Highway has been occupied by a large customs scale, once operated by the United States Bureau of Customs. The scale shed remains, but is now unused. For a ten-year period, between 1959 and 1969, the northern part of Smith Park beneath the existing Highway was utilized by United States Lines for truck parking. Today, the entire portion of Smith Park south of the existing Highway, except for the customs scale area, is devoted to automobile parking.

During the three years ending in late 1973, Smith Park was completely closed to the public. In that period, all of Smith Park was used as a storage site for construction equipment for the West Side interceptor sewer project. The site was fenced, and occupied by a construction firm under contract to the New York City Department of Water Resources. This use was terminated in August 1973, and the firm was required to restore the park to its previous condition, and to provide further improvements worth $1,500. In early 1974, the fences were removed, the area north of the existing Highway blacktopped, and new benches installed.

Smith Park is a local park which has been used principally by the surrounding community. Prior to its use as a temporary construction site, the park functioned as the only recreational and sitting area available to workers from the Chelsea waterfront and the 23rd Street industrial area.

Smith Park is bordered by the existing Highway (above), and by truck and auto service facilities (below).

The Chelsea and Clinton neighborhoods of Community Planning District Four, in which Smith Park is located, have the largest residential population and the smallest amount of open space of the three planning districts within the West Side Highway Project Study Corridor. There are 7.75 acres of open space, contained in small parks and playgrounds, which serves over 46,000 local residents. Smith Park comprises 24 percent of this total community acreage.

In addition, the residents of this area have been unable to make their way to the edge of the Hudson, in order to take advantage of the shoreline for relaxation or recreation. While almost none of the piers in the area continue to house maritime operations, many still stand and are either empty or used for activities unrelated to the water. For example, Pier 57 is used by the Metropolitan Transportation Authority as a bus garage, and Pier 63 is used for moving company warehousing. Thus, extensive areas of the waterfront are closed not only to public access, but to public view as well.

The present total open space acreage of 7.75 acres within the Community Planning District Four portion of Study Corridor represents a ratio of 0.17 acres per thousand residents. With this total, including the refurbished Smith Park, an additional 21.02 acres of park land is necessary in order to bring this area up to the minimum community standard proposed by the Regional Plan Association (RPA). In order to raise the area to the current Manhattan average of 1.42 acres per thousand persons, an additional 57.63 acres would be needed.

Smith Park represents approximately 30 percent of Chelsea's total open space between 14th and 30th Streets, from the River to Sixth Avenue. Chelsea's open space ratio has risen from 6.14 square feet to 9.1 square feet per person, with the addition of 2.92 acres in the public housing complexes of the Fulton, Elliott and Chelsea Houses in the 1960's. The Regional Plan Association recommends a goal of 0.6 acres of open space per thousand residents, or 26.1 square feet per person. Thus, Chelsea is 52.3 square feet per person below the Manhattan average, and 17.0 square feet per person below the RPA goal. Precise figures on patronage are not presently available from PRCA.

The open deck of the Morton Street Pier provides needed recreational space to the Greenwich Village community.

Morton Street Pier

Pier 42 is a recreational facility for local residents situated at the foot of Morton Street, west of Greenwich Village. Known as the Morton Street Pier, it consists merely of a deck 80 feet wide, extending 920 feet out into the Hudson River, in the finger-pier configuration familiar to the West Side waterfront. To the south lies Pier 40 at Canal Street, still active primarily for passenger operations, and to the north lies Pier 45 at Bank Street, currently vacant.

The Morton Street Pier was built in 1876, of concrete deck and timber pile construction. Originally a cargo facility, Pier 42 stood vacant for some time after the cessation of shipping operations there. Considerable pressure developed within the West Village community to convert the pier to a recreational facility. Later the City agreed, removed the shed structure, and opened the remaining platform for public use in 1966. The surface of the pier, about 1.69 acres, is covered with macadam bricks, and is flanked on its lengths by an uneven wood beam platform at a slightly lower level. The pier is owned by the City of New York, under the jurisdiction of the Department of Ports and Terminals. The City Parks Administration provides maintenance, and the Board of Education supplies security services.

The Morton Street Pier is used solely for recreational and institutional purposes today. It is used principally for normal outdoor leisure activities, such as sunbathing, sitting, walking, jogging, picnicking, reading, bicycling, painting and viewing the River. The public facilities consist mainly of the plain pier deck itself, although a few benches and a telephone are available.

Despite the rather sparse facilities, and the deteriorating condition of the platform, the Morton Street Pier is heavily patronized in nice weather, mainly by West Village residents. Up to several hundred people frequent the pier on summer weekdays, and more than 500 people a day regularly appear on the weekends. Food vendors frequent the area of the bulkhead adjoining the entrance to the pier. People come to the pier mostly on foot or by bicycle, having to make their way beneath the existing West Side Highway, and across West Street between parked trucks and moving traffic.

Berthed along the north side of the Morton Street Pier since 1964 is the *S.S. John Brown*, serving as an annex to the Food and Maritime Trades Vocational High School, which is located several blocks away. This ship is being replaced by another, to be named the *S.S. John Brown II*, which is presently berthed alongside the first. The school ship has a daily attendance of about 500 students coming from all over New York City.

Waterside Park is a paved promenade along the River near the foot of the Morton Street Pier.

Waterside Park

Waterside Park is a small water-edge promenade adjacent to the land end of the Morton Street Pier. The 55-foot wide area stretches northward along the bulkhead for about 450 feet, and totals about 0.57 acre. The Waterside Park area is paved with concrete. The park facilities are comprised of 18 benches, nine large planters containing trees, shrubs and flowers, and nine bollards. Waterside Park is on land owned by the City of New York, and is under the jurisdiction of the Department of Ports and Terminals. Maintenance responsibilities for the park are shared by the City Parks Administration and the Department of Sanitation.

Pedestrians and bicyclers must cross West Street beneath the existing Highway in order to reach the Morton Street Pier or Waterside Park.

Waterside Park and the Morton Street Pier really complement one another, accommodating common patronage and use patterns Thus, Waterside Park is used heavily by the West Village community, and by the students and staff of the Food and Maritime Trades High School ship Also similar to the Morton Street Pier, most people come to Waterside Park on foot or bicycle, having to cross West Street under the existing West Side Highway. Further, it should be noted that both of these open space facilities lie almost in the shadow of the existing Highway, as well as being cut off from West Side communities by the elevated roadway

Community Context

The goals and objectives of Community Board Two include future use of the West Village waterfront area for residential and recreational purposes. They call for small parks and playgrounds oriented to the water, for the use of community residents. Thus, the kind of recreational facilities represented by the Morton Street Pier and Waterside Park can be seen as fitting in with the desires of local residents.

Other small, community-oriented recreational facilities in the West Village waterfront area, none of which would be affected by the Project alternatives, include: a vest-pocket park within the Westbeth housing development, which includes sitting areas, children's play equipment and trees, for residents; the James K. Walker Park on Leroy Street, which has a ballfield, basketball courts, bocci courts and a swimming pool, open to the public; the Servalli Playground on Horatio Street, with basketball courts and baseball fields, a new community garden and recycling center at the Saint Vincent's Hospital triangle; Abingdon Square Park, with a children's playground and large sitting area, and facilities being built in conjunction with the West Village Housing Project.

City and community proposals also call for the increased use of the West Village Waterfront area for recreation. The **Plan for New York City** calls for extending the present character of the West Village to the Hudson River, as the waterfront area no longer serves an essential maritime or manufacturing role for the City. That plan also states a need for more parks and recreation areas, some of which should be placed on the waterfront. The **Greenwich Village Waterfront Study** recommends capitalizing on the uniqueness of the waterfront for viewing, sitting and strolling.

Proposed Alternatives

The West Side Highway Project is presenting at public hearing five alternative transportation proposals. In addition to numerous other categories of differences among them, the five alternatives vary in their relationships to existing Section 4(f) park lands. A brief description of each alternative, and its effect upon Section 4(f) properties, will serve to highlight these differences. These alternatives are shown in Illustration B.

Maintenance Alternative

In the usual sense, a "do-nothing" alternative is an option not to undertake particular construction proposals to build a public facility. For the West Side Highway Project, this do-nothing option, or Maintenance alternative, is unusual because it means future use of an existing facility, which presently has negative impacts on the 4(f) lands within the Study Corridor. Thus, there can be no prudent or feasible way to avoid Smith Park, or to reduce the deleterious effects of the existing Highway on the Morton Street Pier and Waterside Park, by maintaining the status quo. In order to consider a broader range of alternatives not including a new highway, the Project has studied, in addition to the Maintenance alternative, an Arterial scheme, in which the present highway would be demolished and replaced by a new local surface street in the existing right-of-way, and a Reconstruction alternative, which proposes modifications to the existing structure in order to remove some of its most dangerous features

The Maintenance alternative would merely preserve the present Highway, an elevated structure running along the Hudson River waterfront from the Battery to 72nd Street, by means of necessary repair and maintenance. From the Battery to 14th Street, the existing Highway is located within the right-of-way of Marginal Street and West Street, which combine to form one broad area of pavement Between 14th and 59th Streets, it is located within the right-of-way of Marginal Street and Twelfth Avenue. Access to the existing Highway from West Street is provided at five locations between the Brooklyn-Battery Tunnel and 40th Street.

Only one of the access points, within Smith Park at 23rd Street, provides full service off and on ramps from both the north and the south. These ramps surround Smith Park and are examples of the substandard geometrics of the old Highway. The existing Highway structure is over 30 years old, and in a serious state of decay. In fact, a large section of the northbound roadway south of 14th Street collapsed in December 1973. Subsequent inspection revealed similar structural deficiencies elsewhere, and the Highway was closed for an indefinite period all the way from the Battery to 46th Street, and between 72nd and 79th Streets. Aside from the deterioration problem, the geometrics and structure of the existing facility inhibit the safe and speedy flow of traffic, and preclude trucks.

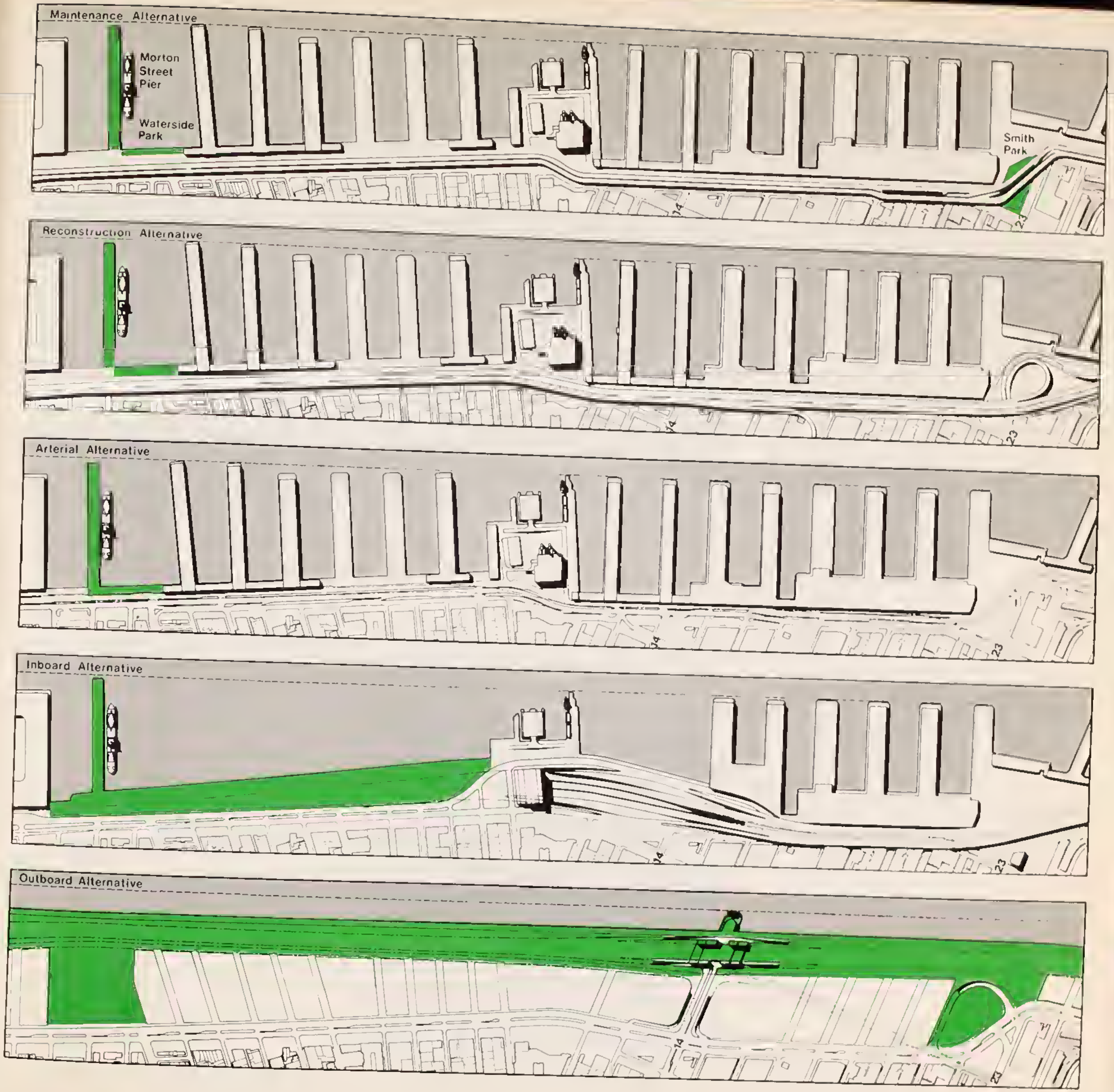
Illustration B West Side Highway Project Alternative Proposals

🟩 Park Lands

North

The Maintenance alternative would require substantial annual expenditures in order to keep the facility in operation. In 1972, maintenance work on the existing Highway amounted to about $1,000,000. This cost does not include the major repairs necessitated by extraordinary problems, such as the collapse last December, in order to put the existing Highway back into operation.

Future traffic levels are likely to be determined by land-use changes in the area, such as the construction of new projects in and near the Study Corridor—Battery Park City, World Trade Center, Washington Street Urban Renewal Area, West Village Housing, Consolidated Passenger Ship Terminal, and the proposed Convention Center These projects will contribute to the traffic load and alter present patterns of travel.


Maintenance Alternative
Morton Street Pier
Waterside Park
Smith Park
14
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Reconstruction Alternative
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23
Arterial Alternative
14
23
Inboard Alternative
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Outboard Alternative
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23

4(f) Effects of Maintenance Alternative

Since this alternative proposal would preserve the existing West Side Highway, it would leave all three 4(f) lands in the Study Corridor just as they are today in relation to the roadway.

Currently, **Smith Park** is seriously adversely affected by the existing Highway, which runs across it as an elevated maze of steel and stone. Nearly half of the total park area now is covered by the roadway, which bisects the park diagonally from northwest to southeast, leaving unequal triangular plots at each corner open to the sunshine. The present physical state of the park would remain unchanged with this Maintenance alternative, as would the adverse environmental conditions due to the presence of the Highway. Assuming an operating West Side Highway under this Maintenance alternative, air and noise pollution levels similar to those generated by traffic in the past would continue to plague the 4(f) lands.

High levels of air pollution would continue until such time as new vehicles, incorporating novel emission control devices, would reach a high enough percentage of total vehicles to raise local air quality substantially. This is predicted to occur by 1983, but may be delayed further by the postponement of statutory deadlines due to the energy crisis. Since all trucks on the West Side would have to continue using local streets, with no choice of using a maintained Highway, and trucks account for a large portion of local air pollution, they would continue to raise pollutant concentrations in such sensitive places as residential and recreational areas.

Noise presents a similar problem. At the noise measurement site nearest to Smith Park, at 23rd Street between Tenth and Eleventh Avenues, the noise levels measured during the Project testing program reached 80.8 dBA during the morning rush hour, and 79 dBA during the same time period on West Street between 19th and 20th Streets. However, the acceptable exterior noise level for parks and residences, according to Federal standards, is between 9 and 10 dBA lower, at 70 dBA. Since the Maintenance alternative would preserve the existing Highway, it would not modify major factors influencing noise, and thus would perpetuate the high noise levels associated with the operating facility.

The Chelsea and Clinton neighborhoods of Community Planning District Four, in which Smith Park is located, have the largest residential population and the smallest amount of open space of the three planning districts within the Study Corridor. This would continue unchanged.

The Maintenance alternative would preserve the status quo for Waterside Park and the Morton Street Pier (above), and for Smith Park (below).

Traffic on the existing Highway also has adversely impacted the **Morton Street Pier** and **Waterside Park**, being only 110 feet from the pier and 60 feet from the park. While there is no physical incursion of the Highway into these recreational areas, the existing elevated roadway seriously hinders access to them. And the chaos of West Street is an obstacle to pedestrians attempting to reach the riverfront. Noise levels measured by the Project at Waterside Park on West Street between Christopher and Barrow Streets were 81.5 dBA at both mid-day and afternoon peaks. At the Morton Street Pier, the noise level was taken as high as 74.9 dBA during the morning peak.

Since the Maintenance alternative would provide only for repairing and maintaining the present Highway facility, no provision for relocation or additional open space, or for improved access to the waterfront is included in this Project option.

Reconstruction Alternative

The Reconstruction alternative would undertake a partial rebuilding of the existing facility, making the Highway capable of accommodating both truck traffic and buses, as well as improving its safety by eliminating some of the most dangerous features. For the entire length of the Highway below 42nd Street, a new deck would be built to replace the present crumbling roadway. For this entire length, the new roadway would be limited to four lanes instead of the present six, with appropriate shoulders and speed change lanes.

Among the many modifications of the existing Highway proposed in this alternative, the following features are especially relevant to the recreational areas in the Study Corridor. Along the Greenwich Village waterfront, except for two short stretches, between Canal and Houston Streets and at the 14th Street curve, the existing structure would be retained, passing near to both the Morton Street Pier and Waterside Park. In the area where the Highway now crosses over Smith Park, the dangerous curve of the present viaduct would be demolished and replaced with a more moderately curving structure. New ramps would be built north of 23rd Street to replace the existing ramps south of 23rd Street. A new northbound ramp would be provided at 18th Street, leading from the Highway to Tenth Avenue. Finally, West Street-Twelfth Avenue beneath the Highway would be reconstructed as a two-way local street.

Like the Maintenance option, this Reconstruction alternative would probably not have any significant effects upon area land use. It would provide improved safety and operational benefits for traffic, even though there would be a reduction from six to four lanes in certain sections. However, an elevated roadway would remain as a significant barrier between the local communities and the waterfront. While there would be no special transit facility provided with this alternative, the improvements to the roadway would allow buses to be run on a reconstructed highway in mixed traffic. The reconstruction of West Street could contribute to improved local bus service, with bus pull-offs or other special features.

4(f) Effects of Reconstruction Alternative

This Project proposal would eliminate **Smith Park** at its present location. In this alternative, the elevated roadway would be moved slightly to the east, and aligned in a more north-south direction in order to straighten the present curve at 23rd Street. The part of Smith Park which would not be occupied physically by the reconstructed elevated road would be taken by the new West Street, leaving three small traffic islands as the only remaining portions of the present park, useless as recreational facilities.

If any Federal monies were used for this Reconstruction alternative, legal and administrative requirements would mandate replacement of Smith Park at some other location in the area. If, instead, City or State monies exclusively were employed to implement this option, the replacement of Smith Park would be at the discretion of those local governments.

If this alternative were selected and implemented with Federal funds, a replacement park would be located east of the reconstructed Highway. This park could be placed along the west side of Tenth Avenue between 18th and 21st Streets, and could provide 2.23 acres of usable recreational land. This location for a Smith Park replacement facility was developed after consultation with the Parks Committee of Community Board Four, and the City Parks Administration, based upon accessibility and feasibility. Such a replacement would increase total usable park space in Community Planning District Four to 8.13 acres, or an average of between 0.12 and 0.19 acres per thousand residents, based on 1995 forecasted population. Moreover, such a new park would be much more accessible to local residents than is the existing facility.

The Reconstruction alternative would not directly impact either the **Morton Street Pier** or **Waterside Park**, both in the West Village area. The modified highway would maintain the present physical and environmental conditions there. Since these recreational facilities would not be impacted by the Reconstruction alternative, no funds would be available to improve or provide additional riverfront recreational areas in the Community Planning District Two area, whether the option were funded locally or federally.

The present condition of the Morton Street Pier, and other existing waterfront facilities, would not be affected by the Reconstruction or Arterial alternatives.

Arterial Alternative

This alternative would remove the structure of the existing Highway and replace it with a new local boulevard style street at ground level, with a transitway depressed beneath the street. The resulting street would offer lower traffic capacity than the present Highway, but could accommodate major improvements in public transit.

The present West Side Highway viaduct would be demolished and West Street-Twelfth Avenue would be reconstructed as an arterial roadway within the existing West Street-Twelfth Avenue right-of-way, between the Brooklyn-Battery Tunnel and West 72nd Street. The transitway which is part of this alternative could accommodate either a conventional subway system or an express bus system, running from the World Trade Center to upper Manhattan and then to the Bronx. The new boulevard along West Street would provide three main traffic lanes in each direction, and would incorporate a sophisticated traffic control system in order to accommodate the traffic volumes in the most effective manner.

4(f) Effects of Arterial Alternative

The New Arterial would follow the same right-of-way through **Smith Park** as does the existing Highway, taking about half of the total official site area of the park. That is, no additional land would be condemned for the Arterial roadway. However, the new facility would carry traffic along the surface rather than on an elevated structure.

This Arterial alternative would preserve the two present triangular segments of Smith Park, east and west of the roadway, with traffic passing closer to them than at present. Such an at-grade roadway would be 35 feet closer to the park areas than the present elevated structure, with resulting increases in air and noise impacts on the park. The overall effect would be the creation of two isolated islands of park bordered on two sides by heavily traveled roads, the new north-south Arterial and 23rd Street.

If Federal funds were used to build this proposal, Federal law would require its replacement. If State or City monies were used to implement it, replacement be at the option of those governments. If Smith Park were in fact replaced for this option, the proposed site would be the same as described for the Reconstruction alternative in the preceding section.

The Reconstruction alternative would continue the present relationship of the Morton Street Pier and Waterside Park to the West Side Highway.

Removing the existing Highway and providing a rail transit system with a station at 23rd Street would stimulate demand for substantial changes in the use of the Chelsea Triangle area. The thrust for redevelopment in response to a transit line would likely be for residential uses in the 23rd Street area, with concomitant demands for more open space and recreation areas.

The Arterial alternative would not physically impact either the **Morton Street Pier** or **Waterside Park** and therefore their replacement is not proposed here. However, the environmental quality around these facilities may well deteriorate somewhat. Traffic carried all at ground level would create a greater concentration of air pollution than would traffic carried at several different levels.

Inboard Alternative

The inboard alternative proposes that the existing Highway be replaced with a new six-lane facility designed to meet interstate standards, and aligned to preserve existing viable adjacent uses in the Study Corridor. The highway alignment is located mostly in the right-of-way of the existing facility, from the Brooklyn-Battery Tunnel to West 42nd Street. Incorporated within the roadway cross-section is space for a transitway, which could accommodate either an express bus or rail transit system.

North of Canal Street, the new facility would be fully depressed below ground level in the West Village area, entirely west of the building line along the east side of West Street. Between Pier 40 and Gansevoort Street, the roadway and transitway would be depressed and covered to protect what is projected to become a predominantly residential and recreational area of the waterfront. West Street would be located so as to provide a 50-foot buffer strip between it and the building line.

North of Gansevoort Street, the highway would emerge from the covered section and begin to rise to become elevated in the vicinity of 16th Street The transitway would remain depressed and would continue in a covered section under a reconstructed West Street. In order to preserve the existing Chelsea Piers within Community Planning District Four, the new highway has been designed as an elevated structure north of 16th Street.

4(f) Effects of Inboard Alternative

This proposal would require taking more than half of the **Smith Park** area, leaving only 0.8 of the present 1.8 acres. At 23rd Stree , the new elevated mainline and a new West Street at-grade would take 1.0 acre of Smith Park.

Since this proposal includes an interstate highway component, the replacement of Smith Park would be required and funded under Federal law. The site proposed for a replacement park is the three block fronts west of Tenth Avenue, between 18th and 21st Streets, near the Chelsea Historic District. This area comprises 2.23 acres, which is somewhat more than the 1.8 acres of the present Smith Park. This site was selected as part of the Project open space planning, after consultation with the Parks Committee of Community Board Four and the City Parks Administration. This replacement facility actually would add to the stock of usable park space in Community Planning District Four.

The Inboard proposal has two interchange variations in the Holland Tunnel area which would have different impacts on the Morton Street Pier and Waterside Park. A double-corridor interchange proposes two ramps going into the Holland Tunnel from the new highway, taking approximately 250 feet of the **Morton Street Pier**, on the landside, and leaving 640 feet of pier in the water. The single-corridor interchange plan would take an additional 60 feet of the pier, leaving 580 feet. In either case, the Morton Street Pier would be temporarily cut off from access from the West Side during construction, and restored to public use upon completion.

Waterside Park would be demolished under both variations of the Inboard alternative, in order to build a depressed highway section directly beneath it. However, after construction, Waterside Park would be replaced by new park land of much larger area—20.9 acres would be available for new park land along the waterfront. The new shoreline would be located approximately 100 feet west of the present site of Waterside Park, and the new parkland would be placed atop the new landfill, along the River. For the double-corridor scheme, the replacement park would run from north of Pier 40 to Gansevoort Street, substituting more than nine times the acreage of waterfront open space than is there now In the single-corridor scheme, the proposed open space along the River would be somewhat larger than even that nine-fold increase.

Thus, this alternative would provide much more park space than is presently available, and would make the waterfront much more attractive and accessible to many more people. This new acreage would raise the Community Planning District Two average to between 0.49 and 0.79 acres of park per thousand residents in 1995.

Outboard Alternative

The Outboard alternative rests on the assumption that the present maritime passenger and cargo activities south of 42nd Street have no economic future. Thus, a West Side Highway Project option could provide a means to assist in the redevelopment of the waterfront, to provide access to the water, more recreational and open space, and new land for other uses, primarily housing. This proposal includes a new six-lane highway depressed and largely covered, and transitway for either express bus service or rail rapid transit that would operate between Lower Manhattan, the George Washington Bridge and parts of the Bronx.

The most dramatic feature of the Outboard proposal is that it would create substantial areas of new land in place of the remaining deteriorating piers on the West Side, and would transform the relationship between West Side communities and the waterfront. The transportation service provided by this alternative would not be appreciably different from that of the Inboard. However, approximately 250 acres of new land would be created by demolishing all piers south of 42nd Street, filling the area between the present shoreline and the new pierhead line, building the new highway and transit facilities depressed in the new land, and then covering them over for most of their length.

Components of the Outboard proposal include a new major waterfront park providing residents with direct access to the shore of the Hudson. This alternative would provide the opportunity, depending upon City decisions, to construct an extensive bicycle path system, or bikeway, from 42nd Street continuously down to the Staten Island Ferry Terminal. Such a facility could be extended in the future through the proposed Manhattan Landing development on the East River, and even further north along the East Side of Lower Manhattan.

4(f) Effects of Outboard Alternative

This Project alternative would eliminate all three 4(f) properties within the Study Corridor, and would replace them with considerably more extensive and accessible open space and recreational facilities.

The transitway and reconstruction of West Street for the Outboard would effectively eliminate **Smith Park**, by using even more of the park land than the existing Highway. However, 20.67 acres of new open space would be created along the waterfront in Community Planning District Four, 7.7 acres of which would be designated as the new Smith Park. This would create a new park about four times the size of the present park. This park area would be part of a total of up to 80 acres of open space to be created along the waterfront by the Outboard alternative. This area would be much more accessible, more attractive, subject to less noise and carbon monoxide concentration, and more relaxing than the existing park. Because the highway would be covered and ventilated, air pollution levels in the park would be unusually low in comparison with levels closer to traffic. Carbon monoxide levels decrease rapidly with distance, and with a buffer space as large as that created in this alternative, no air pollution problems would be expected in the new park. In addition, this alternative would significantly increase the supply of park land in the West Side communites, an effect deemed desirable by the City Parks Administration.

Although the Outboard alignment would eliminate both the **Morton Street Pier** and **Waterside Park**, they would be replaced with at least 2.5 acres, and perhaps as many as 11.5 acres, of new open space at the foot of Christopher Street, along the waterfront. This area would be more conducive to activities such as sports, bicycling and walking, and would not be subject to the noise and air pollution of the present sites. In addition, the perception of and visual contact with the water from the upland areas would be enhanced considerably.

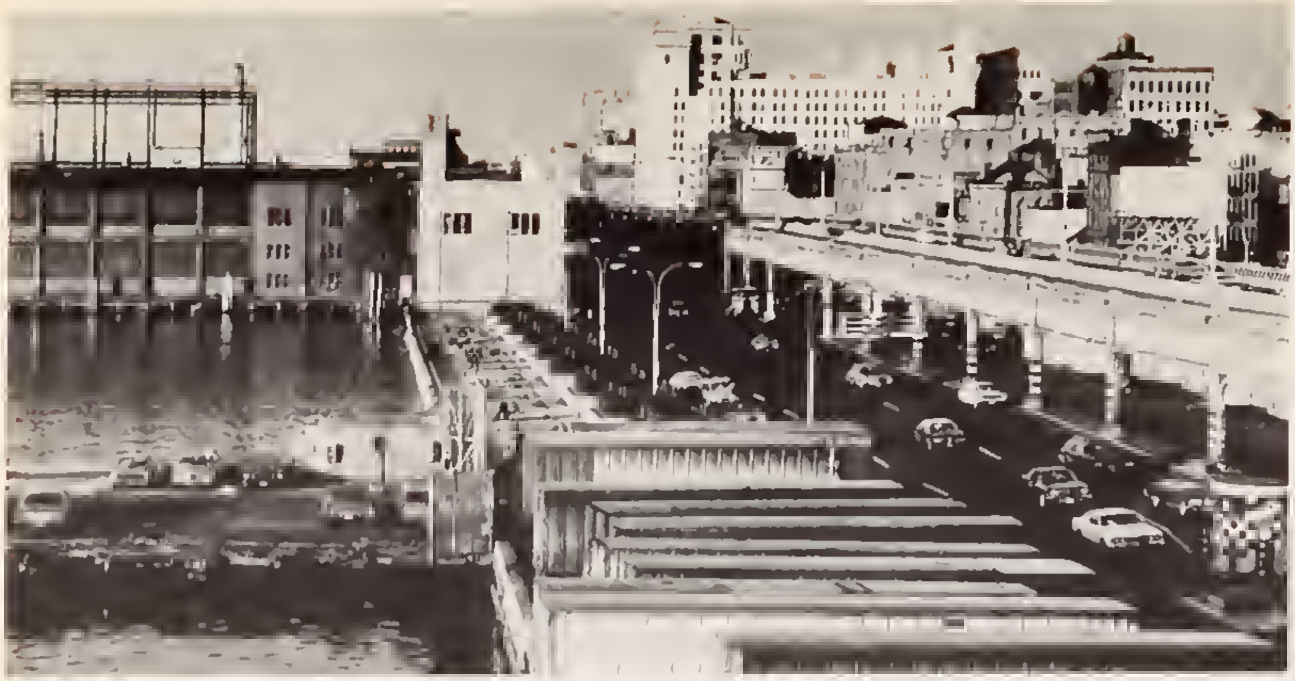
Realignments and Design Options

As set forth above, certain of the Project's five alternative proposals would displace one or more of the three 4(f) properties within the Study Corridor. In such cases, those Project proposals which would employ Federal funding would replace a taken 4(f) facility with one superior in size, access and quality. Smith Park would be eliminated by the Reconstruction, Arterial, Inboard and Outboard alternatives. The Morton Street Pier and Waterside Park would be taken only by the Outboard alternative.

However, West Side Highway Project open space plannings was carried further, beyond examination of this range of Section 4(f) effects attributable to the five alternatives. In the effort to examine other possibilities which both would avoid taking these Section 4(f) properties, and would be prudent and feasible, the Project considered additional locations for the proposed transportation facilities. Several modifications of locations for the five principal alternatives were developed, and are denominated as "realignments" in this discussion. For each such realignment, several configuration variations were considered, which are designated as "design options."

In reviewing the following detailed discussion, it should be kept in mind that the existing situation is a highly unusual one for Section 4(f) consideration, both in terms of the facilities themselves and in relationship to their present context and to the Project proposals. Smith Park is today literally cut in two by the elevated structure of the existing Highway, and additional areas of the park are taken by streets, ramps and parking. Both Waterside Park and the Morton Street Pier are small areas which have been converted from other uses and are completely separated from West Side communities and residents by the structure of the existing Highway and West Street beneath it.

The Project alternatives which would impact these Section 4(f) areas and which would be built with Federal funds include provisions for creating replacement facilities of superior size and location within these communites. This would improve both the extent and quality of access to the waterfront. Additionally, it would provide a significant increment in parks for people in an area of the City which is lacking in such space today. All of these factors are relevant to a consideration of prudence and feasibility of particular proposals in this West Side area.



Any realignment which would avoid the Morton Street Pier and Waterside Park would impact adjacent upland areas to the east.

Morton Street Pier and Waterside Park

Because of the peculiarities of the locations and configurations of the Morton Street Pier and Waterside Park, no suitable transportation realignments were found which would meet the Congressional intent written into the Section 4(f) statute by avoiding these facilities in the Outboard alternative.

The only possible location for a realignment which would avoid the taking of Waterside Park and the Morton Street Pier would be to the east of the existing West Street. However, while such a location would preserve those recreation areas in their present conditions, pedestrian access to them across the new roadway would be so difficult as to seriously impede their utility and availability for area residents. Further, although it might be technically possible to construct the proposed transportation facilities in such an alignment from an engineering standpoint, the resulting high social and economic costs, in terms of disruption and relocation, would make such a proposal imprudent and unfeasible.

Any design options for such a realignment, such as depressing a new facility beneath the existing 4(f) lands, would require the total rebuilding of both Waterside Park and Morton Street Pier. This would mean that these open space areas would be disrupted for a considerable period, while their sites were occupied by construction activities for the transportation facilities. The time and money that would be required for such total rebuilding in place would be more prudently applied to providing the larger and more accessible replacement facilities in new locations, as components of the Project alternatives, as described in the previous section.

Smith Park

Three realignment locations were examined for the area of Smith Park. The new transportation facility would be located east of Smith Park in Realignment 1, west of Smith Park in Realignment 2, and underneath Smith Park in Realignment 3. There are five design options for Realignment 1, four options for Realignment 2, and two options for Realignment 3 Each combination of a realignment and design option could be applied to modify a particular Project alternative, as follows:

- **Reconstruction** Option 1b
- **Arterial** Option 1e
- **Inboard** Options 1a, 2a, 3a, 3b
- **Outboard** Options 1c, 1d, 2b, 2c, 2d

Realignment 1

Realignment 1 is located immediately adjacent to the east boundary of Smith Park. Engineering and construction of such a realignment would be possible in a purely physical sense. However, other factors, such as cost, relocation of businesses, disruption and, in several design options, incompatibility with community goals and poor environmental quality, would make this realignment not "prudent and feasible."

Although Realignment 1 would avoid occupying the site of the park, the close proximity of the facility to the park would continue to pose some problems of air and noise pollution. Moreover, the required right-of-way would displace businesses and increase acquisition costs. Such a realignment location to the east would bring the new transportation facility nearer to the residential section of Chelsea and, in most cases, would make the remaining park less accessible to Chelsea residents.

In those design options of Realignment 1 which assume a minimum change in land use between now and 1995, a new highway east of the park would prematurely condemn marginal service businesses along West Street. Such plans would accelerate change, while the clear intent of the Project proposal for a new inboard elevated highway is to preserve and strengthen existing uses. In Options 1c and 1d, where a new West Street would be located east of Smith Park and new land created along the waterfront, the park would remain adjacent to a heavily traveled thoroughfare.

Based upon consideration of such consequences, Realignment 1 and its design options were deemed unfeasible and imprudent, and were therefore eliminated from further study. Details of the design options were developed for this realignment are presented below. (See illustration C.)

■ **Option 1a** Option 1a would keep Smith Park intact, placing a new Inboard elevated highway 30 feet above and immediately adjacent to the eastern boundary of the park, with a rebuilt West Street directly under the new highway.

This option would require relocation of 76 businesses on 24 properties, at a total cost of $31,400,000. This would be $21,800,000 more than the right-of-way for the Inboard alternative, and would disrupt 64 more businesses on 16 or more properties than the Inboard alternative, including the Starrett Lehigh Building.

This option would also separate Smith Park from the local community, making it necessary for residents to pass beneath the highway to reach the park. Finally, by prematurely condemning marginal service businesses along West Street, this option would accelerate land use changes in the area, while the basic assumption of the Inboard alternative is preservation of existing uses.

■ **Option 1b** If the Reconstruction alternative were implemented, the elevated roadway could follow Eleventh Avenue to the east of the Park, instead of going through it, and then turn west at 23rd Street, rejoining the existing Highway in West Street at approximately 26th Street. The 23rd Street ramps would be shifted northward without reducing their service or greatly altering their design.

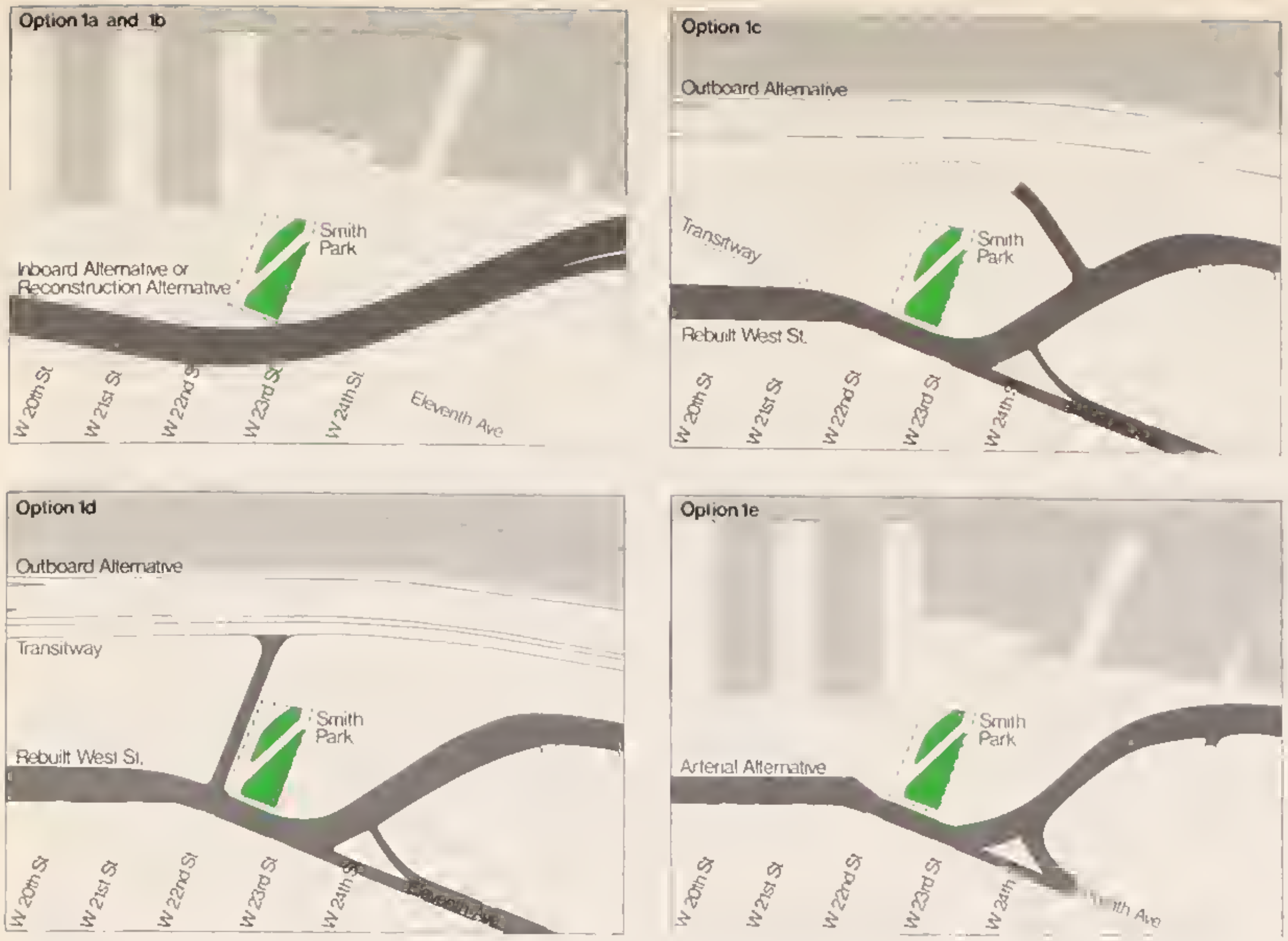


Illustration C Realignment 1: East of Smith Park

🟩 Smith Park

▨ Design Option

North

This option would dislocate a total of 19 commercial enterprises on five properties, at a cost of $7,900,000. This modification would disrupt eight more businesses and cost $4,300,000 more than the Reconstruction alternative.

In addition, Smith Park would remain adjacent to a heavily traveled roadway, consequently subject to whatever air and noise pollution would be generated by the traffic which it would carry. Finally, this option would separate Smith Park from the Chelsea community.

■ **Options 1c and 1d** Option 1c is a variation of the Outboard alternative, with a transitway under Eleventh Avenue and a bus ramp at 23rd Street. In the design modification, rebuilt West Street, which crosses the park diagonally in the proposed alternative, would be moved to the east, and the bus ramp shifted slightly to the north.

Option 1d is the same option as 1c, except that it would modify an Outboard alternative with a transitway in Twelfth Avenue. The only difference between Option 1c and 1d is the location of the transitway ramp.

These options would necessitate the acquisition and relocation of 25 to 30 more businesses than the Outboard alternative, at an additional cost of $6,200,000. These additional properties would have to be taken in order to accommodate the rebuilt West Street to the east of the park.

In addition, the new West Street would divide Smith Park from Chelsea. The park would be bounded by roadways along two sides—West Street on the east, and the transitway ramp along the south. This would defeat one underlying purpose of the Outboard alternative, which is to improve the quality and location of park space and recreational facilities.

■ **Option 1e** Option 1e would move the Arterial alternative to the east of Smith Park. It would follow approximately the same route as Option 1b, but would use a greater portion of the Chessie railroad yards.

The Arterial alternative would follow the right-of-way of the existing Highway, and thus would result in no relocations or acquisition costs. However, this option would modify the required right-of-way, resulting in the displacement of six commercial tenants on four properties at a cost of $4,900,000.

In addition, while this modification of the alignment would avoid Smith Park, the resulting environmental quality of a park would be susceptible to the traffic carried on an adjacent major arterial roadway.

Realignment 2

Realignment 2 is located west of Smith Park. It has four design options, consistent with the design constraints applied to the Project alternatives. It was found impossible to construct a new roadway west of Smith Park, as in Option 2a, and still to retain the Chelsea Piers. In other design proposals, new land created along the waterfront would be reduced by using a right-of-way west of Smith Park for a service road. For example, Options 2b, 2c and 2d would subdivide a large parcel of new land, and thereby create several nearly useless islands on West Street. Only in Option 2d would the resultant island be functional, enveloping Smith Park and buffering it from surrounding traffic. But Option 2d is undesirable, in that it both uses upland blocks, as in Option 1d, and reduces the area of usable new land on the waterfront, as in Option 2c. Following are the details of the particular design options which were considered for this realignment, but which were determined to be neither prudent nor feasible. (See Illustration D.)

■ **Option 2a** Option 2a basically proposes that the Inboard alternative be shifted to the west in order to bypass Smith Park. Again, a rebuilt West Street would be directly under the new highway.

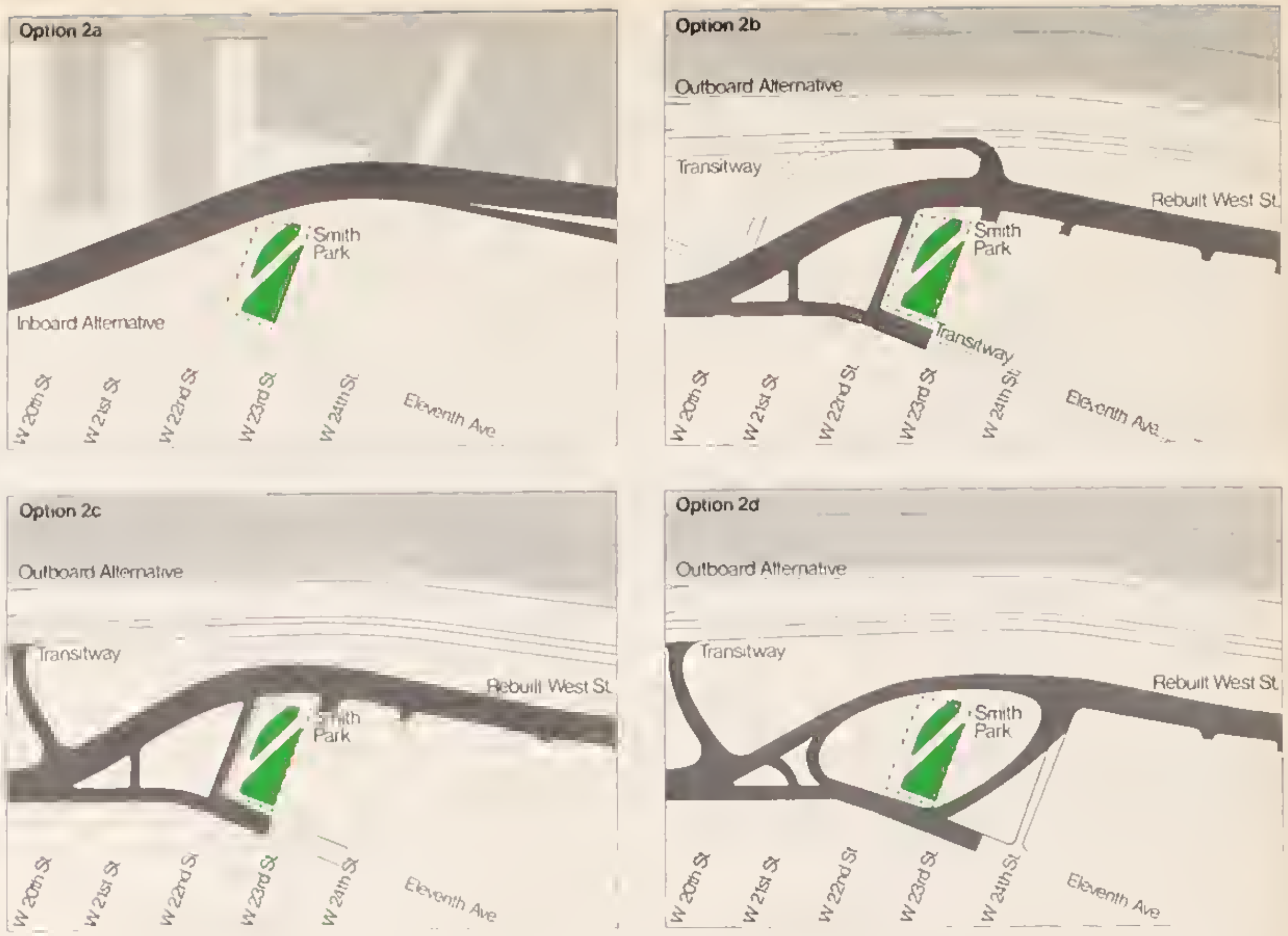


Illustration D Realignment 2: West of Smith Park

🟩 Smith Park

▨ Design Option

North

This option would increase the acquisition costs by $1,500,000 over the Inboard alternative, to a total of $11,100,000. While it would require less relocations than the Inboard, avoiding one parcel and preserving eight businesses, it would disrupt the Chelsea Piers. At the piers, this option would require condemnation of the truck parking area, and parts of the headhouses and Pier 62. Such an effect would defeat a major land-use objective of the Inboard alternative—preservation of the Chelsea Piers, as resources for possible revitalization for shipping or other uses.

■ **Options 2b and 2c** Option 2b is a design modification of the Outboard alternative, with a transitway following Eleventh Avenue. Rebuilt West Street, which would bisect Smith Park in the Outboard proposal, would be relocated to the west, and the bus ramp would be altered to conform to such relocation.

Option 2c is a realignment design for the Outboard alternative which would vary from 2b only in the location of the ramp connecting the transitway and the local street system.

These options would not displace any more businesses or result in any more right-of-way acquisition costs than the Outboard alternative. Further, they would save Smith Park. However, they would leave the park a virtual island surrounded by traffic. In addition, they would relocate the transitway ramp to 20th Street, creating additional traffic movements and islands to the south of Smith Park. Finally, such a modification would reduce the size of a parcel of the new landfill to be created as part of the Outboard alternative, a principal objective of that alternative.

■ **Option 2d** In Option 2d, also a variation for the Outboard alternative, a rebuilt West Street would be split around Smith Park, with the northbound lanes on the east side, and the southbound lanes on the west side of the park

This option would necessitate relocation of ten businesses, at a cost of $1,700,000. This too would make Smith Park a virtual island in a sea of roadways, with bus, truck and auto traffic moving along all its sides. Pedestrian access would be quite difficult, as local residents would have to cross the busy rebuilt West Street to reach the park from Chelsea.

Realignment 3

The Project has considered a third realignment, tunneling underneath Smith Park. This possibility was discarded because construction would demolish the park, and would require its total rebuilding in the same location. Once the necessity for rebuilding Smith Park is created, the desirability of employing the requisite time and money to relocate it on another site far outweighs any potential benefits of a tunneling scheme, in both the short and long runs. Thus, this realignment too was determined to be imprudent and infeasible. The design options considered for this realignment are detailed below.

■ **Options 3a and 3b** Options 3a and 3b are variations of the Inboard alternative The new highway would follow West Street from 16th Street to 22nd Street, and would swing west under Smith Park to Twelfth Avenue at 26th Street. However, unlike the Inboard alternative, the highway would remain depressed in covered sections at 18 feet below grade up to 24th Street, where it would rise gradually to 30 feet above grade at 30th Street. Both Options 3a and 3b would be located in a covered section through the Community Planning District Two area to Gansevoort Street, then become depressed but open between 14th Street and 24th Streets, and then become elevated from 30th Street northward.

The transitway for each would follow the proposed Inboard route to 21st Street, where it would turn onto Eleventh Avenue. The service road would be located alongside the new highway to 16th Street, where it would continue on top of the covered section from 16th to 22nd Streets. At that point, a rebuilt West Street would go either east (Option 3a) or west (Option 3b) of Smith Park, and then run adjacent to the new highway from 24th to 30th Streets.

A depressed highway must have a minimum width of 188 feet In the vicinity of the Chelsea piers, the available space is only 173 feet wide, or 15 feet less than would be needed for these sections. The needed additional 15 feet could be taken wholly on the east or on the west, or equally on both sides. The latter appears least desirable because it would condemn land along both sides of the new roadway, rather than displacing uses along just one side of the new right-of-way

If land is taken on the east, in Option 3a, 74 businesses on 17 properties would have to be condemned at a cost of $28,000,000. This would require an additional $18,400,000 and taking an additional 62 businesses on an additional nine properties, over the Inboard alternative.

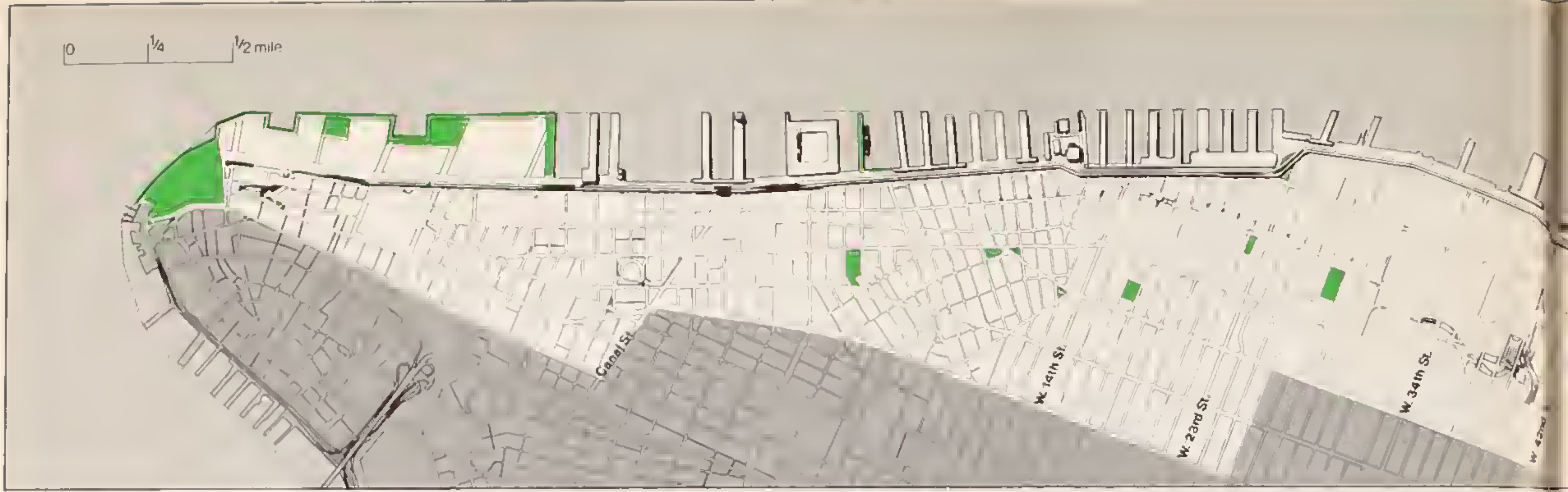
If the land is taken on the west, in Option 3b, right-of-way acquisition would require displacing four businesses on 11 parcels, at an expenditure of $20,700,000. This would cost $11,100,000 more than the Inboard alternative, and take an additional three properties, though eight fewer businesses. Also, construction of a depressed section to the west in this option would impose the additional difficulty and cost of relocating the City's recently completed 96-inch intercepter sewer, which runs beneath the bed of West Street.

Coordination and Other Considerations

The Project conducted numerous special review meetings on open space and park lands within the Study Corridor with interested public agencies and community groups. On several occasions, Project staff met with the Federal Bureau of Outdoor Recreation and the National Park Service, and the New York City Parks, Recreation and Cultural Affairs Administration. These meetings included presentations of Project work, discussions of possible 4(f) lands in the Project area, and probable impacts of the Project alternatives on park lands, with options for replacement and betterment of open space.

The Project also solicited the advice of City and State agencies and professional experts with regard to possible archeological effects of the alternatives. These included the National Park Service, the New York State Historic Trust, the New York City Landmarks Preservation Commission, and faculty members of Queens College and New York University After their review of the alternatives, six areas of potential archeological significance were identified along the River within the Study Corridor. Since most of the waterfront between the Battery and Midtown consists of fill, a deep excavation could yield objects of interest dating back to the 17th century, as recent experience has shown in other parts of Lower Manhattan. Any such excavation should provide for archeological exploration under the guidance of an expert in that field. However, the extent of such construction varies among the alternatives. Thus, the development of a specific archeological program should be included in the phase of detailed planning and design following the selection of a particular alternative for implementation. Such archeological activities in conjunction with construction would be eligible for Federal funding (United States Code, Title 23, Section 305.)

In accordance with Federal and local laws protecting and preserving structures and sites having historic or architectural significance, including Section 106 of the Historic Preservation Act of 1966 (United States Code, Title 16, Section 470 f), the Project staff identified and documented all such structures and sites within its study area. A special Project report listed properties which enjoy protected legal status by either appearance in the National Register of Historic Places, or designation as New York City Landmarks, or both. (See **Report on Landmarks,** West Side Highway Project Report No. 5.16, June 1973.) That report also listed other properties over 30 years old which are considered widely as architecturally significant, but which presently enjoy neither Federal nor local legal status. This category consists of properties currently proposed for National Register or City Landmarks designation, as well as other noteworthy buildings as identified by local community groups, special interest organizations and public agencies It was found that none of the West Side Highway Project alternative plans would physically disrupt or destroy any of the landmarks, historic sites or architecturally significant buildings, or their surrounding environments, within the Study Corridor.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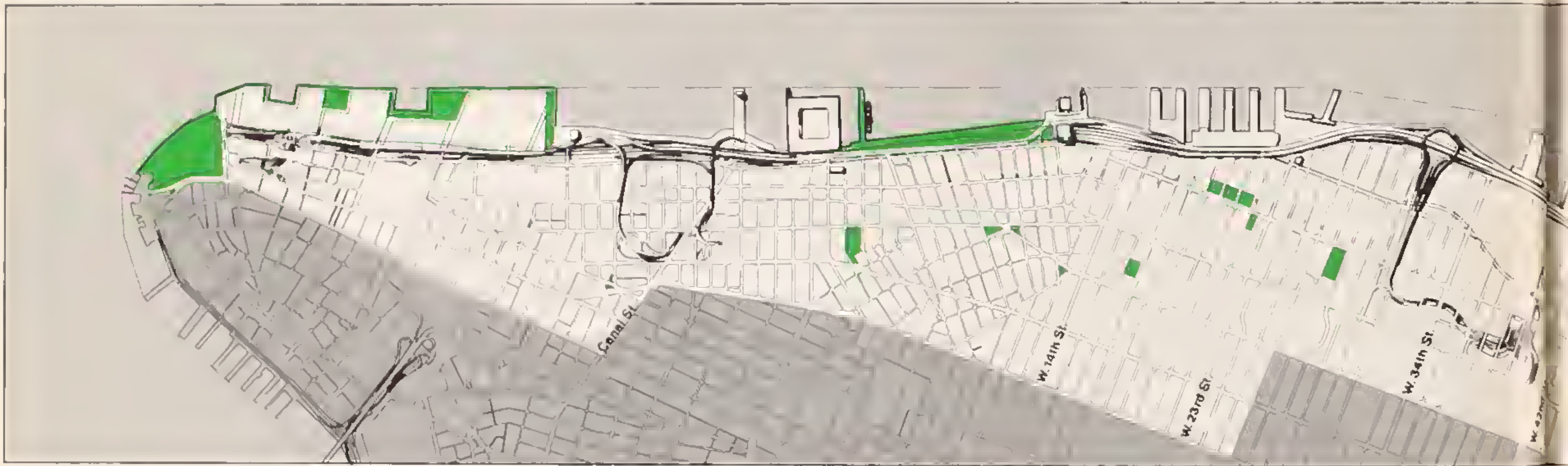
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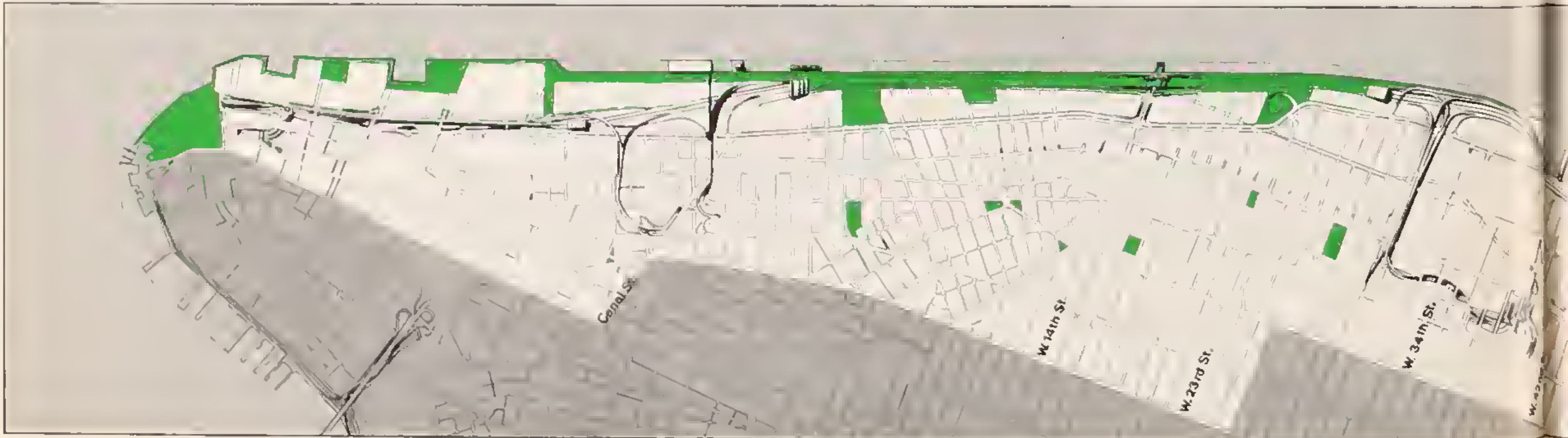
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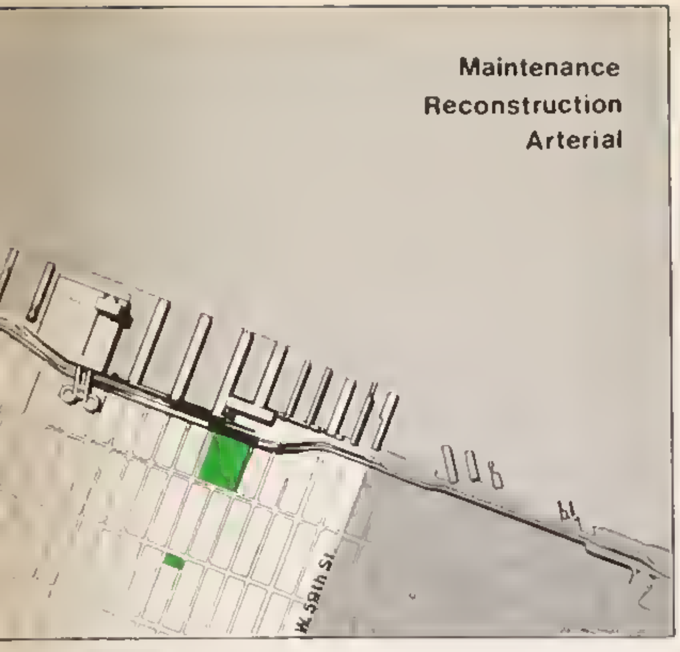

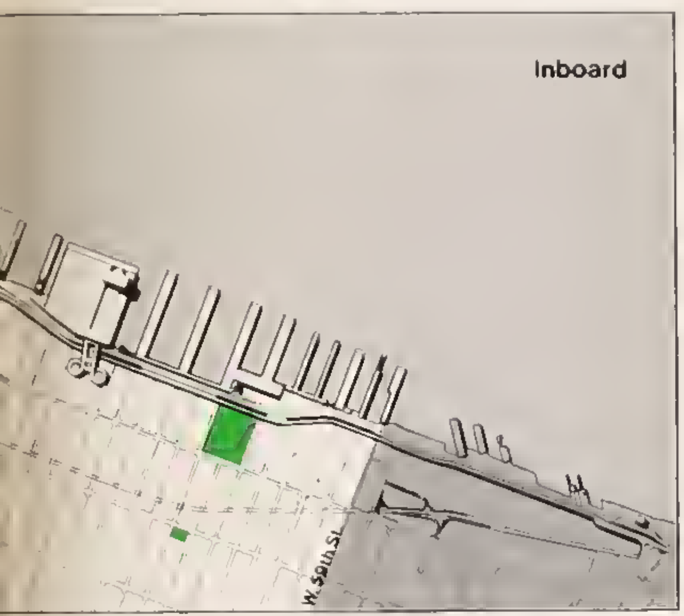

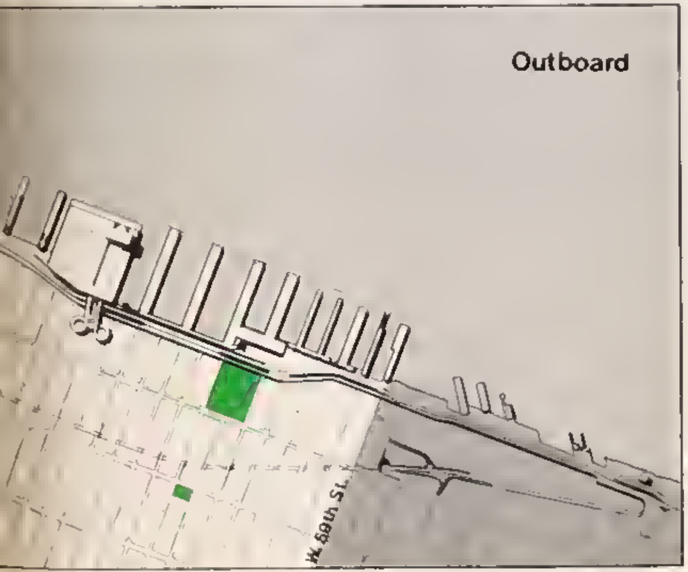

Illustration E Park and Open Space Proposals for the Project Alternatives

🟩 Park Lands and Open Space

☐ Project Study Corridor

North

Conclusion

As this discussion has indicated, the consideration of location realignments and design options did not yield any additional alternatives which would be prudent and feasible, and which would avoid the Section 4(f) lands. Certain of the realignments and options examined proved to leave the park space physically intact, but would subject it to effects of environmental pollution. Others would require significant additional dislocations of residents and businesses, or would necessitate the expenditure of substantial additional monies, in order to preserve the status quo.

The five alternative transportation proposals of the West Side Highway Project do include a range of varying effects upon Section 4(f) properties, as a result of planning to minimize harm to park lands within the Project area. Those which would impact Section 4(f) areas with a federally funded undertaking would provide new park and recreational areas or replacement facilities which would be considerably larger and more accessible than the areas provided by Smith Park, the Morton Street Pier and Waterside Park today. These Project alternatives would thus produce new community assets in neighborhoods where people presently enjoy far too little park space. In this way, the Project has included extensive planning to maximize the availability of parks and open space, as well as access to the waterfront, on the West Side.

For all of these reasons, the relationship between the West Side Highway Project and Section 4(f) presents a highly unusual situation. This unconventional context must be taken into account in evaluating the alternative proposals.

Appendix

Prerequisite to the application of Section 4(f) to a particular piece of property is a determinaton by the officials with jurisdiction over it that such property is of local, state or national significance. As a part of the planning associated with future open space and existing park lands in the Study Corridor, the West Side Highway Project prepared a description of the potential 4(f) lands in this area. That description was forwarded to the appropriate offices of the City of New York, requesting review and an official determination of significance. The letter of response from the New York City Parks, Recreation and Cultural Affairs Administration is reprinted here in full.

The City of New York Parks, Recreation and Cultural Affairs Administration PRCA

The Arsenal
830 Fifth Avenue, New York, New York 10021

Edwin L. Weisl, Jr.
Administrator, Commissioner of Parks

Telephone 360-8101

April 3, 1974

Mr. Lowell K. Bridwell
Executive Director
West Side Highway Project
19 Rector Street
New York, New York 10006

Re: Section 4(f) Lands in the West Side Highway Project Area

Dear Mr. Bridwell:

This Administration has considered the question of lands potentially affected by West Side Highway Project Plans which are significant for purposes of Section 4(f) of the Department of Transportation Act of 1966.

We have concluded, in agreement with the preceding Administration, that there are three such significant parcels in the area concerned. Thomas F. Smith Park, located between Eleventh and Twelfth Avenues, along the south side of 23rd Street, is under the exclusive jurisdiction of the Parks, Recreation and Cultural Affairs Administration. The Morton Street Recreational Pier, located on Pier 42 at the foot of Morton Street, and Waterside Park, along the bulkhead north of Pier 42, are both situated on property of the New York City Department of Ports & Terminals, but are administered jointly by this agency and the New York City Board of Education.

In our examination of existing park areas and recreational facilities on the West Side, we have found that the West Village and Chelsea communities presently enjoy very little open space, in terms of both acreage, and acreage in relation to population. This is true when measured against the present Manhattan-wide average, or against accepted professional standards.

This present open space deficiency is expected to become more serious over the next 25 years, in light of the trend toward increased residential development in the western portions of Chelsea, Greenwich Village and the Washington Market area. Substantial increases in population in these areas will further reduce the ratio of open space to the numbers of people living nearby. Thus, West Side areas badly need, and could well benefit from, provision of additional park and recreational facilities.

In addition to quantitative considerations, we have also determined that the significant Section 4(f) areas and facilities which exist today in Chelsea and the West Village are far from optimum. Smith Park, the Morton Street Pier and Waterside Park are all substantially isolated from heavily residential areas. In order to get to the Morton Street Pier and Waterside Park, people must cross the wide expanse of West Street beneath the existing West Side Highway. All three facilities are very close to the Highway at present, with the main roadway and ramps bisecting Smith Park.

In short, the present recreational areas in these West Side communities are far from ideal in terms of size, location, and facilities. While they are valuable assets for this area of the City, their value derives primarily from the fact that they are the only such facilities located in neighborhoods with far too little good park space at present.

In this context, we have reviewed the five West Side Highway Project alternative proposals in relation to their open space elements and potential impacts. Certain of these alternatives would take one or more of significant Section 4(f) lands. We understand that these Project proposals include provisions for replacing such lands with new facilities, in new locations which would provide much improved access, area and quality for local residents. While we value the parks available to the public in these areas today, we also recognize that there is considerable room for improvement.

In light of such considerations, in the event that a Project alternative were selected for implementation which would impact a Section 4(f) parcel, we believe that the public interest would not be served by reproducing inadequate existing facilities in place, or by merely maintaining the status quo.

Rather, implementation of such an alternative would provide an opportunity for the Parks Administration and local communities to improve the open space and recreational conditions in these areas.

Such an opportunity should be employed creatively by this agency in cooperation with the West Side Highway Project, in order to relocate and replace the present park lands in the area with significantly larger, better and more accessible community recreational assets.

Sincerely,

Edwin Weisl, Jr.
Administrator

WAREHOUSES INC.
BONDED AND FREE